Prevention of Sleet on High Tension Transmission Lines—*Operating Characteristics of Enclosed Fuses and other engineering articles dealing with phases of operating practice*

UNIV. OF MICH. LIBRARY

Electrical World

New York, March 10, 1917 McGraw-Hill Publishing Co., Inc. Vol. 69, No. 10 10c a copy

Gold Medal San Francisco 1915
HUGHES
Acknowledged World's Greatest ELECTRIC RANGES

Ultimately the greatest revenue producer of the Electrical Industry

HUGHES ELECTRIC HEATING COMPANY
TAYLOR STREET AND WALLER AVENUE
CHICAGO
TORONTO WINNIPEG BOSTON

Weston

Why the Weston Company Makes Instrument Transformers

A few years ago, at the time the Weston Company had perfected its now world-famous group of A. C. Switchboard Indicating Instruments, it found itself face to face with a very serious situation.

The Company had developed these Instruments to the highest state of perfection, but there were on the market no transformers of sufficient accuracy and serviceability to use in combination with them! Exhaustive tests were made on all types of Transformers available in this market, and the Weston branches and representatives in foreign lands were commissioned to scour the field and send samples of the best Transformers procurable.

Not one of the Transformers thus obtained in this country or abroad met the requirements even approximately.

The Weston Company did not want to make Transformers, because of other work it deemed of greater importance; but failing to find Transformers that it could recommend to be used in conjunction with Weston Instruments with assurance of accuracy better than 1 per cent for the combination, it endeavored to have them built to special designs. Even then the results were far from satisfactory.

Realizing finally that the problem of Instrument Transformers was one that must be solved as other Weston problems had been solved, the Weston Engineering Staff thoroughly analyzed the subject and completed designs for various groups of Portable and Switchboard types of Current and Potential Transformers of a degree of accuracy and serviceability that completely met the practical requirements of switchboard practice and precision determinations in the laboratory.

These Weston Transformers established a new standard for Instrument Transformer design and construction.

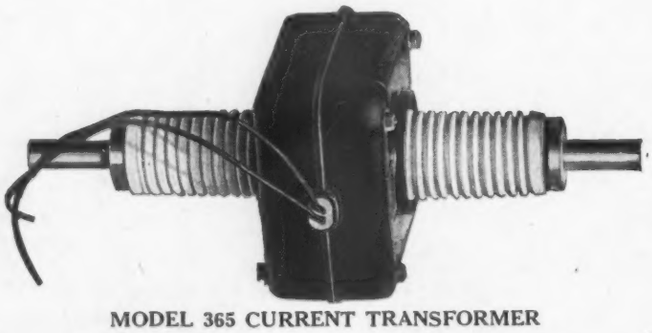
As might have been prophesied, the improvements made by the Weston Company resulted in improvements on the part of other instrument manufacturers, and this is one more instance of apparatus remaining stationary, so far as merit was concerned, until a Weston type blazed the way for betterments. The significance of this is apparent.

Model 312

PORTABLE INSTRUMENT TRANSFORMER

Weston Switchboard Instrument Transformers described in Bulletin 1501.

Weston Portable Instrument Transformers described in Bulletin 2001.



MODEL 365 CURRENT TRANSFORMER

For use on 13,200 Volt Circuits.

Home Office and Factory
13 Weston Ave., Newark, N. J.

New York	Chicago
Boston	Detroit
Philadelphia	Toronto
Buffalo	Montreal
Richmond	Winnipeg
Cincinnati	Vancouver
Cleveland	Berlin
Pittsburgh	London
St. Louis	Florence
Denver	Paris
San Francisco	Petrograd
Johannesburg	S. Africa

Weston Electrical Instrument Co

Electrical World

The consolidation of Electrical World and Engineer and American Electrician
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 69 NEW YORK, SATURDAY, MARCH 10, 1917 No. 10

Ideals in Editorial Service

BIGNESS by itself is significant only when it carries with it the power to render a greater service, the desire to take and carry the greater responsibility. The consolidation of the two great publishing companies, the McGraw Publishing Company, Inc., and the Hill Publishing Company, into the McGraw-Hill Publishing Company, Inc., as announced in our issue of last week, is potential with the possibilities of this greater service. Strength is in the union, not alone because of the resources at the command of this great new publishing house, but because the co-ordination of effort makes possible the fuller realization of ideals of editorial service which each year become increasingly difficult to carry out as our industries become more complex and the costs of rendering service to readers increase. Each of the journals in the combined companies has been edited with serious purposes. All have analyzed the intimate needs of their readers and built publications which have striven not only to present the news of engineering and business progress but to interpret this progress for the guidance of their respective industries.

Heavy Depreciation—A Burden of Prosperity

WEAR and tear go on rapidly with hard usage. Depreciation may come from any one of several causes, but it is sure to come from use. It is unfortunate that we cannot do more than estimate the annual rate of depreciation. With all the experience of the past to guide us, we still must guess the percentage of value in plant which disappears year by year. We say that under normal conditions the life will be five years or ten years, and if we are wise we plan our depreciation charges accordingly. Then when this question appears to be settled an abnormal condition develops to disturb the careful figures prepared in easy-going days, and immediately the rate of depreciation on some elements of plant rises to double its old figure. The truth is, that this is what has actually taken place within the last year in steam stations. Boiler-room parts are wearing out twice as fast as they would do if they were subject to only ordinary service. Extraordinary loads, making it necessary to run plants at full capacity, demanding that every part shall do its utmost, mean a reckoning which cannot be avoided. We make extra money, but we accelerate the insidious physical depreciation which requires early replacement. Extra gross profits are illusory if they blind the senses to the costs which follow in their train. Scrap value now is high, but if it is low when the actual replacement goes through the books the net cost will be high. The benefits of the long period of heavy demand are not real benefits unless they provide amply for the consequences of heavy wear which accompany them.

The Ranking Problem in Operation

COAL cost plus shortage gives the sum of the chief operating problem, which shows no sign of vanishing. Acute it has been for nearly all steam stations and it still looms large as the haunting question mark in operations. Our report tells of great central stations caught with a meager ten days' coal supply and the danger of blizzard ever present; of smaller stations measuring their supply in anxious hours, not days; of demands for service necessarily refused; of street lighting curtailed or cut off; of industrial establishments closing temporarily; of city authorities commandeering enough of the precious commodity to keep their utilities physically alive. Cost does not count when the alternative is to stop operations, to confess inability to give service; and coal cost is a very heavy burden which cannot be shifted to the consumer by daily fluctuations in rates. It has been a hard and costly lesson, a lesson which was not required by most properties, for ample coal reserve is a first principle of plant management. We shall see the results of the lesson in future plans, it will be less easy to catch the stations napping in times of light coal supply. Storage capacity will be more extensive, coal piles will bulk larger, foresight will remember the hindsight view of the trying winter of 1916-1917.

The Water-Power Fiasco

CONGRESS has come to an unseemly and scandalous end with most of its important work left undone. We refrain from commenting on its sins of omission with respect to national defense, partly because we would not wish to scourge the few guilty over the shoulders of the many innocent, and partly that adequate and publishable words fail us. We merely wish to call again attention to the fact that the water-power bills have gone down in the general wreck, insuring another probable long season of struggle before the country is able to utilize the natural resources which it possesses, and which before action can be taken it may most keenly need. The wasted energy of the nation due to negligence in developing these all-important hydraulic resources is a grave loss to national wealth. Every cubic foot of water that falls unutilized is valuable material thrown away, and in this case thrown

away without cause, and to the great detriment of the country's industries. If the history of the last two years has shown anything it has proved that even a pacific nation may readily be put in a place where conservation of all its economic resources becomes a prime necessity.

In spite of all that has been said and written about the need of provision for the fixation of atmospheric nitrogen in one form or another, substantially nothing has been accomplished, nor can anything be done until the cheaply developable powers are set free for human utilization. In peace or in war nitric acid lies at the very foundation of many chemical industries of the greatest national importance, and it is painfully evident that the time may come when we may bitterly regret not having made at least a start in the utilization of power for this purpose. The balance between supply and demand is infinitely more delicate than people generally realize, so sensitive indeed that a very small increase in the latter produces startling changes in price which are not compensated by a subsequent fall. This is indeed the theory of corners and other artificial interference with the relations between supply and demand. The rise and fall of prices with the decrease and increase of supply are not along a line, but describe a sort of hysteretic loop which represents the profits of the operators. We are going through just now a flurry in the coal market which bears hard on many industrial establishments. For this reason if for no other the fullest utilization of our water powers is necessary and the failure of the bills before Congress is a misfortune. They may not have been perfect, but they at least represented a long step in the right direction toward the ultimate goal of cheaper power for American industries. Even after all necessary rights are granted it is a long operation to put hydraulic power into service and to distribute it where it will do the most good. It will be hard to reckon in millions the annual loss represented by the dog-in-the-manger policy which has been followed in respect to these undeveloped resources, and harder still to speculate upon the increasing loss which the lack may force upon the nation.

Characteristics of Inclosed Fuses

THE open fuse for protecting electric circuits from accidental current overloads is a very simple device and was very early introduced into the art; but its mode of operation is comparatively complicated, when examined in detail. The steady temperature of the fuse wire rises until the power input by I^2R is just equal to the power output dissipated by conduction, radiation and convection. When the temperature is rising rapidly, by the sudden application of current through the fuse, the thermal capacity of the fuse-metal substance comes into account, as well as the dissipation.

The I^2R thermal input into the fuse metal is not the same for the same fuse at the same current strength, because R is not constant. This resistance increases with the temperature of the fuse. The conductively dissipated heat, issuing longitudinally from the fuse into its clamps, is roughly proportional to the temperature elevation. The radiatively dissipated heat, emerging as invisible light from the fuse in outward straight lines, is very roughly proportional to the temperature elevation of the metal, depending actually on the fourth power of the absolute temperature. The great variant, however, is the convectively dissipated power, emerging from the fuse in the ascending stream of heated air particles. This convective output for a given transverse velocity of air passing the fuse, varies approximately as the temperature elevation of the fuse above the impinging air. If there is no wind, the heat communicated to the surrounding air has to create its own local movement, at a comparatively low velocity. If, however, the fuse happens to be exposed to a draught or wind, the convective output is very greatly increased. A large amount of the uncertainty of open fuses is attributable to accidental variations in their convective thermal output. If the fuse is sealed into a vacuum chamber, like the filament of an incandescent lamp, the convective output is almost completely eliminated, and only the conductive and radiative outputs are left. This procedure of inclosing fuses in evacuated glass chambers, makes them more definite and reliable as to current-carrying capacity, but greatly reduces their simplicity and cheapness.

The inclosed fuse, or fuse embedded in a chamber of powdered non-conducting substance, is a great improvement on the open fuse, in regard to definiteness of behavior and current-carrying capacity. The convective output is eliminated as though the fuse were in vacuo, except in so far as concerns the surface of the external case or containing cylinder. The thermal output is now nearly all conductive; but the thermal storage capacity of the filling material comes into very appreciable evidence. In the steady state, the temperature of the fuse settles at the point where the I^2R thermal input equates the total thermal conductive output, as far as the surface of the cylindrical cover, with minor modifications beyond that surface, owing to mixed thermal dissipation. Variations in the evironment as to wind and location will influence the final melting current; *i.e.*, a ventilated location will increase the ultimate carrying capacity somewhat; but with sudden current rises and rapid overloads, such changes of environment have negligible influence. Under all such sudden applications of current the inclosed fuse behaves much more definitely than the open fuse, besides being better protected from dust, moisture and oxidation. Moreover, the inclosed fuse does not scatter molten metal. The quantitative theory of the behavior of inclosed fuses is much easier than that of open fuses; but has never been reduced to simple engineering terms, and only fuse designers, as a rule, are interested in it.

The article by Walter Arthur on the performance characteristics of inclosed fuses, which we print this week, throws light on the subject from an experimental standpoint. The effects of the coarseness of filler, of initial temperature, and of the nature of the filler, on the time of application before blowing, are clearly brought out.

The Fight Against Sleet

IN a climate like that of the northern United States the danger from sleet on transmission lines is a serious one. On the earlier systems before the suspension insulators came into use the only danger from sleet which had to be seriously considered was the actual mechanical failure of the cables, insulators, or some part of the supporting structure. A heavy coating of ice combined with strong wind may actually bring down a line either by parting the wires or by collapse of the supports. Fortunately, in a well-designed line this dangerous combination is one very rarely formed, so that failure of service from this cause has been rather rare. With the coming of the suspension insulator, however, the conditions were materially changed. In using such insulators there is a certain lengthwise flexibility controlled only by the anchoring of the spans at more or less frequent intervals. If all spans were loaded equally no trouble would result because, whatever the spacing of the wires might be unloaded, a somewhat analagous spacing would result when all were borne down by a load of ice. If, however, one of the wires is much more heavily coated than the others or, being initially like them, retains its coating after its neighbor has been freed from it, the vertical clearance between spans may be very considerably decreased. The loaded span comes down, while the wire below it, freed from ice and perhaps pulled up by loads still retained on neighboring spans, rises, so that there may be considerable danger of contact or sufficient approximation of the circuits to start an arc. In addition, there may be electrical breakdown from very large snow masses or icicles, but this contingency is so rare that it may be practically neglected. The variations in sag of spans due to this unequal loading on suspension insulator lines may be of surprisingly large amount, and it is particularly likely to cause trouble on double-circuit tower lines where the wires are spaced one above the other. On horizontal single-circuit lines it is very unlikely to result in trouble since the swaying of the loaded lines is extremely unlikely to be sufficient to bring them into even approximate contact.

Our paper on this interesting topic in this issue gives some valuable information regarding sleet preventive measures as derived from the Pennsylvania Water & Power Company, which operates three 70,000-volt tower lines, two from the power plant to Baltimore, Md., the third to Lancaster, Pa. The first Baltimore line carried two circuits spaced 7 ft. apart in a vertical plane. The second Baltimore line carries at present only a single circuit, but the crossarms are 9 ft. apart, and staggered, the middle conductor being 2.5 ft. further out than the upper and lower ones. The virtue of this difference in construction is well shown by the fact that while the first line has been twice short-circuited from sleet, the second one had sufficient clearance. between the lines, even under extreme conditions, to cause no trouble. Some valuable experiments were tried out on the single-circuit Lancaster line, built with 7-ft. clearance, to determine how great the actual sag due to loading might be. This was done by actually loading the cable through one entire span and measuring the effect in sag of the cable and deflection of the insulators from one strain insulator to the next, over a distance of seven spans. In a 640-ft. span the increase of sag, due to a loading equivalent to a half-inch coating of ice, proved to be 15 ft., the effect of the load being chiefly to pull over the suspension insulator strings so as actually to shorten the distance between supports and thus to drop the catenary to a corresponding amount, which agreed very closely with the theoretical result in thus shortening the span with the same length of conductor.

Staggering the wires, and more frequently anchoring, can reasonably be expected to free the line from danger of this particular sort, but to avoid trouble with the existing lines which were not staggered experiments were tried as to the amount of current required on the cables to keep sleet from freezing upon them. Sleet forms only when the temperature is just a little below the freezing point, and it does not form through a wide range of temperature, so that the possibilities of loading the circuit sufficiently to get above this critical temperature seem reasonably good. Trial showed that when the circuits, which were of 300,000 circ. mil, were carrying about 300 amp., there was very little likelihood of the adherence of sleet. This plan of campaign against sleet has been tried in practice with good results by cutting out on the long Baltimore line one or more of the three circuits so as to maintain the load at about the required point. At times when the normal load was not sufficient to reach this result even with one circuit, quadrature current was added by feeding back through one of the circuits to under-excited generators, a somewhat heroic remedy, but one which worked. The obvious course in most cases would seem to be the installation of suspension insulator lines with the conductors staggered enough to limit the danger from unequal sag.

Co-ordination of Scientific Research

IN a pamphlet sent by the editors some weeks ago, an editorial program for the co-ordination of scientific research in the electrical industry was announced. The response to this invitation to forward the broad research movement in the electrical industry was immediate. The editors wish to thank the writers of these many letters and to announce that beginning with the issue for March 17, the ELECTRICAL WORLD will publish monthly in the third issue, a Research Department. This department will be conducted by Vladimir Karapetoff, professor of Electrical Engineering at Cornell University. Professor Karapetoff will present our program for the new department in the issue for next week. He will be glad to send to research men in university, central station, industrial and private laboratories the preliminary program and to receive their comments and suggestions for the forwarding of the work of scientific research in the United States.

Prevention of Sleet Trouble on High-Tension Transmission Lines

Nature of Sleet Troubles—Tests to Determine Maximum Sag of Conductors—Line Current Required to Prevent Formation of Sleet During Storms—Operating Procedure to Prevent Troubles from Sleet

BY RALPH L. THOMAS
Member Engineering Staff, Pennsylvania Water and Power Company

SLEET storms, in a broad sense, may be considered to include any weather condition that causes a deposit of ice or heavy, icy snow on branches of trees, wires, etc., which may be a prolific source of trouble on an overhead transmission system. During the years 1910 to 1915 several interruptions due to these causes occurred on the high-tension lines of the Pennsylvania Water and Power Company. Such trouble, however, has now been practically eliminated, partly by improved mechanical design of the lines, but more especially by the *prevention* of sleet formation by keeping the temperature of the cables above the freezing point. The necessary temperature rise is secured by operating at low power factor, or if this method is inadequate, by short-circuiting one line and subjecting it to a heat run.

Vigilance and co-operation between patrolmen and operators have been found essential to success. If ice is once allowed to form, much more current is needed to clear the wires on account of the heat required to melt the coating of ice, and the damage may be done before this is accomplished. Prevention is proverbially better than cure.

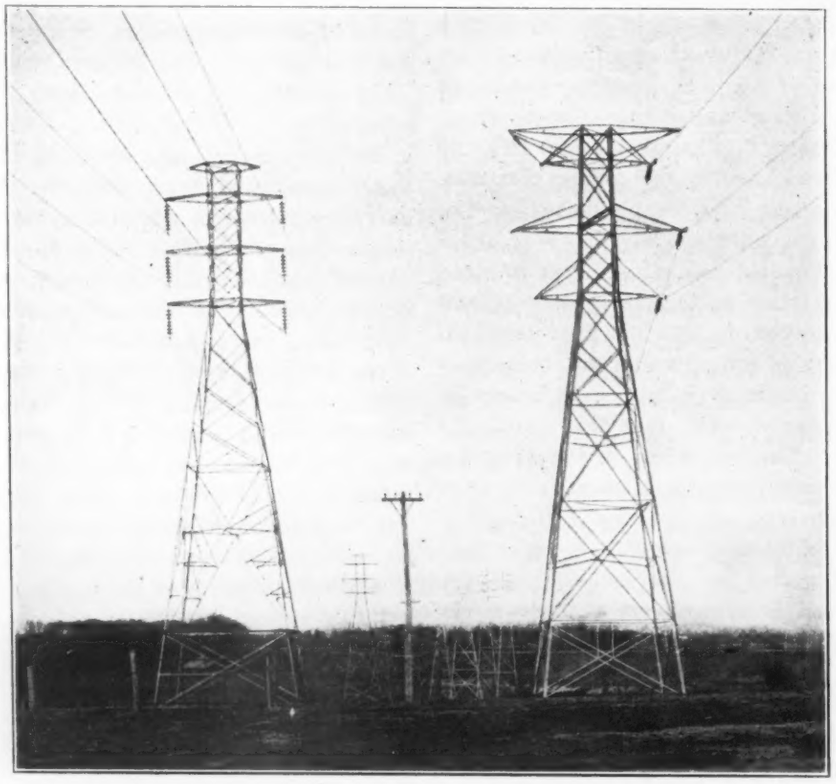


FIG. 1—BALTIMORE TRANSMISSION LINE SHOWING OLD STYLE TOWERS ON LEFT AND NEW STYLE ON RIGHT

The old style towers carried conductors in a vertical plane while the new style carry conductors in a staggered position. The tower shown at the right in this case is a strain design.

In the following text a brief description is given of tests from which the best methods of protection were determined, with a statement of the operating procedure.

THE NATURE OF SLEET TROUBLE

Sleet damage may be either mechanical or electrical, or both. The factors involved are:

1. Mechanical failure of cables, insulators, crossarms, poles, or towers. Such failure may be caused by the sheer weight of the ice load, usually combined with excessive wind load due to the increased area in the path of the wind. Pure mechanical failures are very rare on a power line carefully designed and constructed in accordance with standard rules of loading, and may be classed with those unusual catastrophes, the complete protection against which is debatable. These failures could practically be eliminated by extreme assumptions of loading in designing the line, but it is a question of balancing the loss in money and service prestige caused by such interruptions against the increased investment cost of extremely safe lines.

2. Electrical breakdown and short-circuit may be caused by very long icicles on insulators or between wires, or by masses of ice or snow on insulator strings. The experience and tests of the power company, however, indicate that this almost never occurs.

3. Electrical breakdown and short-circuit may be caused by mechanical unbalancing or distortion, as by unequal sag due to uneven distribution of the ice load. Such electrical breakdown, followed by a power arc, may weaken the cable sufficiently to cause mechanical failure, and it is sometimes hard to distinguish between cases 1 and 3.

The mechanical remedies for the second and third troubles are shortening of the span, using more anchor towers, using pin type or rigid insulators, increasing the spacing of conductors, or changing their arrangement.

On a high-tension line strung on flexible suspension insulators, anchored only at strain towers several spans apart, the third trouble mentioned above is of most frequent occurrence. On such a line, if one span of one phase is loaded more heavily than other spans in the same section between strain towers, all the suspension insulators on that cable in that section will incline toward the heavily loaded span, thus taking up the sag in the lightly loaded spans and adding it to the sag in the heavily loaded span. Thus the latter cable may be brought close to the one next below it. Even if the

latter is not in the same vertical plane, the wind may swing the wires together.

It will be shown that on this type of line the spacing of conductors required to give complete insurance against such trouble is prohibitive. Nevertheless, the experience of the Pennsylvania Water & Power Company is that the "staggering" of the conductors in a vertical plane is of great value, and that this precaution, combined with electrical sleet preventive measures, is an effective protection.

DESCRIPTION OF LINES

The Holtwood generating station of the Pennsylvania Water & Power Company feeds three 70,000-volt steel tower lines. Two of these, paralleling each other on a private right-of-way 100 ft. wide, transmit energy to Baltimore, 40 miles distant, while the other carries power to Lancaster, Pa., a distance of about 14.2 miles.

On the first Baltimore line (No. 12), carrying two three-phase circuits (Nos. 1 and 2), the conductors are spaced 7 ft. apart in a vertical plane. On the new Baltimore line (No. 56), carrying at present only one three-phase circuit (another to be installed in the future), the crossarms are 9 ft. apart, and the conductors are staggered, the middle conductor being about 2.5 ft. farther from the center line of the tower than the upper and lower conductors, as shown in Fig. 1. More strain towers are also used, the maximum number of spans between such towers being five. All the conductors on the Baltimore lines are 300,000-circ. mil, 19-strand aluminum cables.*

Since the construction of the second Baltimore line (No. 56) in 1914, both circuits on the old line were short-circuited on two different occasions during sleet or snow storms, while the new circuit was not affected. The Lancaster line (No. 34) was built in 1913. It consists of a steel tower line carrying two three-phase circuits, the cables of each circuit being spaced 7 ft. apart in a vertical plane. There are 136 towers, of which forty-three are strain and ninety-three suspension towers. The average length of span is about 550 ft. The conductors are No. 0 B. & S. gage, 7-strand copper cable. The insulators at standard suspension towers consist of strings of six units each of the Ohio Brass Company's 10-in. porcelain disk type. At anchor towers the strain insulators consist of seven units each. The conductors were drawn up to a tension of 535 lb. at a temperature of 25 deg. C. In a span of 550 ft. this gives a sag of about 23 ft. The line was designed for an ice coating of 0.5 in. measured radially, and a wind pressure of 10 lb. per square foot at a temperature of minus 25 deg. C.

MAXIMUM SAG

The greatest possible sag due to unequal loading would occur if ice formed on one span only, or a more probable condition, if ice had formed on all spans but had fallen off all but one. The worst possible condition would occur if the cable below this heavily loaded cable were free of ice, and had been pulled above its normal position by an adjacent loaded span.

Perhaps formulæ for these conditions could be derived theoretically, but it is believed that they would be so complicated as to be entirely impracticable, and that simplified approximate formulæ are likely to be applicable only to the cases for which they are created. Recently an attempt has been made to derive an approximate formula for the deflection of the lower ends of the insulators in terms of the length of the span, the stressed length of cable, and the load, and the sag is computed by assuming that the tensions in the loaded and unloaded cables are the same. The writer believes, however, that it is impossible to derive an approximate formula of general application for the linear deflection of insulators which does not involve the length of the insulator string (or the angular deflection) and the number of spans between strain towers. The best method of determining the sag analytically would seem to be to start at one of the anchor towers and work to the other, span by span, determining the deflection by trial and error. Prof. Harold Pender gives such a method in his "American Handbook for Electrical Engineers," pages 1697-1699.

*For a complete description of these lines see a paper by A. Bang on "Four Years' Operating Experience on a High-Tension Transmission Line," Trans. A.I.E.E., 1915. Vol. XXXIV, page 1243.

MECHANICAL SAG TESTS

In order to determine experimentally how great the increase in sag might be, some interesting mechanical tests were carried out by the Pennsylvania Water & Power Company in the summer of 1913 on the Lancaster line described above. Later in the same year V. H. Greisser reported the results of somewhat similar tests on an experimental line of the Washington Water Power Company (Trans. A. I. E. E., 1913, Vol. XXXII, page 1829).

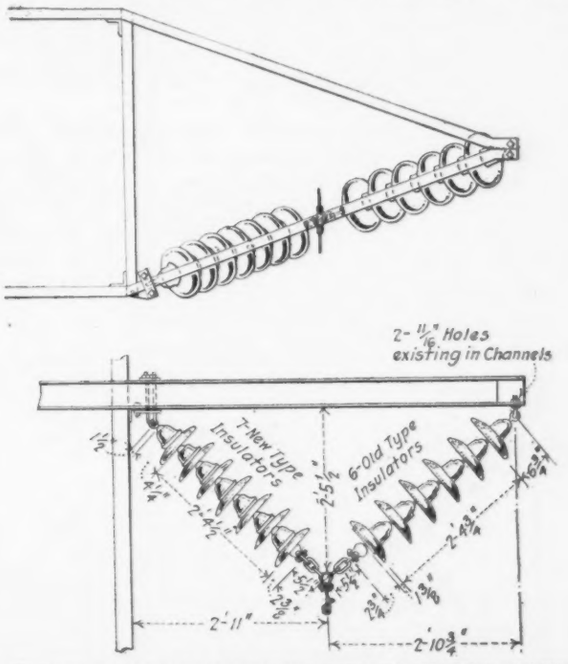


FIG. 2—INSULATOR ARRANGEMENT USED TO STAGGER CONDUCTORS ON OLD STYLE TOWERS WHICH HELD CONDUCTORS IN VERTICAL PLANE

Evidently the greatest sag due to sleet can occur in one of the spans in the section between the two strain towers which are farthest apart. At the point where the tests were made there are seven spans of a combined length of 4152 ft. between strain towers. For topographical reasons the span chosen for observation was the third from a strain tower. Its length is 640 ft. and the spans on either side are 792 ft. and 550 ft.

The first test made was to imitate an ice load on one phase of one span only, and measure the increase in sag. It can easily be computed that a 0.5-in. radial coating of ice on a No. 0, 7-strand cable imposes a load of about 0.545 lb. per linear foot of cable. In order to imitate this load weights were loosely clamped to the cable so that they could easily be drawn along. These weights were pulled out on to the span and held at the proper spacing (16 ft.) by means of a messenger rope, the weight of which was taken into account in computing the spacing. The arrangement is shown in Figs. 3 and 4.

After the load was applied, the sag of the cable was approximately 40 ft., or 15 ft. greater than before the

weights were put on, as determined by means of a transit. Before the application of the load the deflections from the vertical of the suspension insulators supporting the phase tested were found to be negligible. After the load was applied the deflections of the bottom clamps, measured by plumb-bob and rule, were as follows:

TABLE I—DEFLECTION OF INSULATORS—SPAN NO. 84-85 LOADED

Tower No.	Deflection	Direction of Deflection
82	Strain	South
83	0 ft. 6 in.	South
84	2 ft. 0 in.	South
85	2 ft. ½ in.	North
86	1 ft. 0 in.	North
87	0 ft. 7 in.	North
88	0 ft. 3 in.	North
89	Strain	North

The new length of the loaded span is seen to be approximately 4 ft. shorter than the original length, or 636 ft. The sag computed by ordinary formulæ for this span, using the new loading of 0.867 lb. per foot, and the length of cable derived from the original sag, will be found to check the experimental sag closely. The length of a suspension string of six insulators from point of support to cable is 3 ft. 4 in.

After these observations the spans on either side of the loaded span were weighted in the same manner. With three spans thus loaded, the sag of the middle span was found to be approximately 31 ft., or 6 ft. greater than when there was no load on the spans. The deflections of the insulators in this case are given in Table II.

TABLE II—DEFLECTIONS OF INSULATORS WITH SPANS NO. 83-84 NO. 84-85, NO. 85-86 LOADED

Tower No.	Deflection	Direction
82	Strain	South
83	1 ft 5 in.	South
84	0 ft. 1 in.	South
85	0 ft. 11 in.	North
86	2 ft. 4 in.	North
87	0 ft. 9 in.	North
88	0 ft. 5 in.	North
89	Strain	North

After all weights had been removed the cable did not return to its original position. The sag of span No. 84-85 was 0.5 ft. greater than originally. This was to be expected, as it is not likely that the insulators would

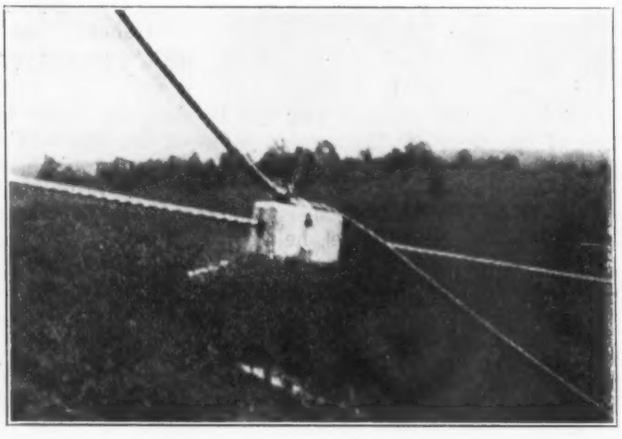


FIG. 3—LOADING WEIGHT USED IN SAG TESTS

all assume exactly their original positions, and that the sag would be distributed throughout the seven spans in exactly the same manner. Also the temperature may have been slightly different (the two measurements were taken on consecutive days), and there may have been a slight stretching of the cable, or a little slipping in the clamps.

The temperature during the tests was about 25 deg. C. The temperature with an actual sleet load would be about 0 deg. C. No attempt has been made to reduce the results to the latter conditions, as only approximate results were desired. The results are sufficient, however, to show that the spacing required absolutely to prevent trouble on this type of line from unequal load and sag is prohibitive.

The mechanical tests, as well as experience and observation during actual sleet storms, indicate the danger of allowing sleet to collect on the transmission lines, and the desirability of tackling the problem at its source by preventing the formation of sleet on the wires by keeping the temperature of the cables above the freezing point during the storms. In 1914-1915 several tests were made to determine the amount of current necessary to accomplish this. The current required depends on the atmospheric temperature (which determines the temperature rise necessary), the weather conditions and the physical characteristics of the wire.

In 1914-1915 heat runs were made on the type of conductor in service on the Baltimore lines. One of the tests was made on the actual transmission line. The others were made on short experimental lengths of cable. In some cases the cables were sprinkled with water in a finely divided state in imitation of rain. In three of the tests a dead cable, referred to as an "idler," was placed near the cable being tested and the temperature rise of the latter was measured with reference both to the temperature of the atmosphere and to that of the idle cable. It was found that there was a difference in these when the sun was shining or rain falling.

The results of these tests are given in Table III. The actual currents used ranged from 278 to 478 amp., but the temperature rises were reduced to the basis of 300 amp. for comparative purposes by multiplying the observed rise by $\left(\frac{300}{\text{actual amp.}}\right)^2$, since it has been shown both by theory and experiment that, for the same external conditions, approximately $T = I^2/K$ where T = temperature rise, I = current, and K = a constant.

From this table it will be seen that the data are rather meager, and that the amount of current required is rather indefinite. Nevertheless, it is believed that except under extraordinary conditions 300 amp. on the 300,000-circ. mil aluminum cable will prevent the formation of ice. Sleet has never been observed on a cable carrying that current.

TABLE III—RESULTS OF HEAT RUNS ON 300,000 C. M. ALUMINUM CABLE

Amperes (Adjusted)	Wind Vel. Miles per Hour	Temp. in Deg. C. of Water Used for Sprinkling	Atmos. Temp. in Deg. C.		Temp. Idle Cable	Temp. Rise of Loaded Cable in Deg. C.		Conditions of Test
			In Shade	In Sun		Above Idler	Above Atmos.	
					Deg. C.			
300	High	None	+13	....	.....	....	6.5	Transmission line test, cloudy windy weather. No rain.
300	None	None	+21	....	.....	....	21.	Indoors.
300	1.8	Zero	-3.3	....	-3	7.3	7.6	Outdoor test. Ice formed on idler only.
300	6.4	Zero	-8.7	-4	-6	2.5	5.2	Outdoor test. Ice formed on both cables. Less on loaded cable.
300	3.6	Cold, Rain	-0.2	....	0	3.1	3.3	Outdoors. Natural rain with a little sleet, which melted from cable.

There is considerable uncertainty as to the maximum temperature rise which should be provided for. In the opinion of the Baltimore office of the U. S. Weather Bureau, the minimum wet bulb temperature during a sleet storm is —3 deg. or —4 deg. C., and this is borne out by the power company's experience.

The velocity of the wind and the rate of precipitation

are probably the most important factors. Opinions differ as to whether or not a high wind is likely to occur during the formation of ice or sleet. It is very likely, however, to *follow* the formation of ice, which is another argument for prevention.

A great service would be rendered if operating companies would systematically observe the current carried by cables on which ice does and does not form, as well as other conditions such as atmospheric temperature, wind velocity and rate of precipitation. A compilation of such observations would be of great aid in determining the line current which should be maintained during sleet storms.

PREVENTIVE OPERATING METHODS

The only customers of the Pennsylvania Water & Power Company are the public utility companies in Baltimore and Lancaster. The co-operation of these customers renders possible methods which could not universally be adopted. The first requirement is the immediate reporting to the power-house operator at Holtwood by patrolmen, substation operators, or any other employees to whom the information may come, of the presence on the line, or approach, of conditions tending to form a deposit of ice or heavy snow on the lines.

Referring first to the Baltimore lines, on receipt of sleet report, if the load is less than 60,000 kw., the Holtwood operator cuts out one of the three Baltimore circuits. This is then short-circuited and grounded at the substation end. At Holtwood it is connected to the low-tension bus. The heat run consists of about 390 amp., or 5000 kw.

Meantime if the load is not sufficient at normal power factor to put 300 amp. on each of the six conductors remaining in service, the customers are asked to underexcite their synchronous machines or to increase the "wattless" current, so as to bring the line current up to 300 amp. Such under-excitation at the receiving end increases the line drop, and the limiting condition is reached when the Holtwood generators are fully overexcited (all rheostats cut out and maximum "boost" on the booster) and the substation voltage drops below normal. Should this limit be reached (allowing, of course, a small margin for control) before the line current reaches 300 amp., one circuit is given the preference and is brought up to a load of 300 amp. The lightly loaded circuit and the circuit on heat run are then interchanged if necessary, so as to keep both free from ice. If the sleet conditions occur during peak load, all three circuits are left in service until the Baltimore load decreases to 60,000 kw. at the Holtwood end.

Before the above method was finally determined upon, and especially before the load had grown to its present proportions, other schemes were tried, which will be briefly outlined.

If the sleet occurred during the early morning hours, the Baltimore load, when less than 24,000 kw., was carried on one circuit only. The other two circuits were tied together at the Baltimore substation. At the generating station, one circuit was short-circuited, and the loop thus formed was subjected to a heat run with current supplied by two generators and two transformers. When the load began to increase, all three circuits were put in service, and circulating current was provided as follows: Five over-excited generators in parallel fed two circuits through their respective transformers. Two other generators with open field circuit were connected to the third circuit through their transformers. At the substation the connections were normal—that is, the three groups of transformers, one for each circuit, were paralleled on the low-tension side, but not on the high-tension side. "Wattless" current was circulated from the over-excited generators through the lines back to the generators with open field. In other words, the latter generators were excited by the former. Sufficient current was thus secured to keep the temperature of the lines above the freezing point.

Referring now to the Lancaster line, this is normally operated in parallel with the Baltimore lines. If the voltage on the latter at the generating end is considerably raised, as already pointed out, by under-excitation of receiving apparatus, the main Holtwood bus voltage may become too high for the Lancaster circuits, in which case the line drop is much less than in the Baltimore circuits. In this case the Lancaster system is segregated, with one generator, transformer and auxiliary bus.

The best method of preventing the formation of sleet on the Lancaster circuits has not yet been definitely determined. Formerly one of the two circuits was taken

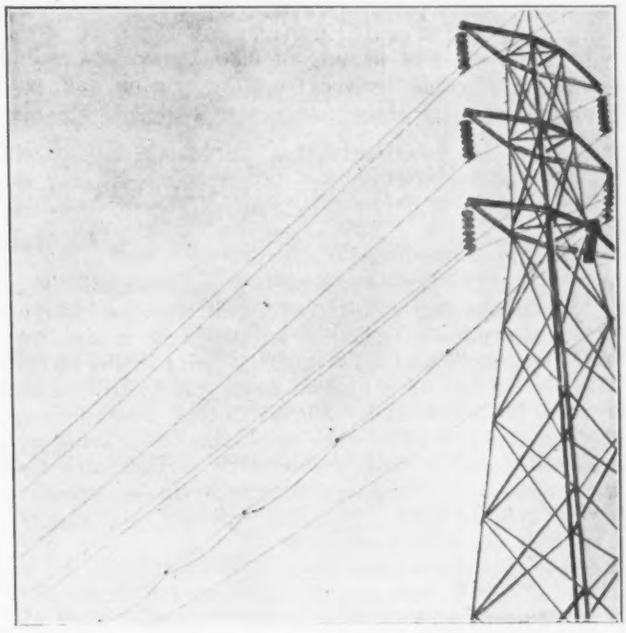


FIG. 4—CABLE ARTIFICIALLY LOADED TO IMITATE SLEET LOAD

out of service and subjected to a heat run. This, however, required a separate generator, which can no longer be spared. One scheme which may be tried this winter is a heat run on one circuit with 2300-volt energy supplied at the Lancaster end, feeding into a short-circuit at Holtwood. A special "sleet bus" consisting of three cables strung beneath the roof trusses of the switch room in two sections, with suitable connections through an oil switch to the low-tension bus, and through disconnectors to the three outgoing Baltimore circuits, has been installed in the generating station in order to facilitate making the sleet heat-run connections.

These methods of keeping the lines clear, with modifications, have been in use now for nearly two sleet seasons, and have proved effective. Nevertheless they must be regarded as still in the experimental stage. Their efficacy depends largely on the immediate reporting of threatening weather conditions to the operator at the generating station.

This is well illustrated by the partial interruption of April 8, 1916. Early on this morning heavy, wet snow began to fall between Holtwood and Baltimore, which was not reported to the generating station. This snow accumulated on the cables unevenly and short-circuited both circuits on the old Baltimore line. During this partial interruption one span of this line was observed in which, on each circuit, the middle phase cable had sagged below the lower cable, there being no snow on

the latter. Tapping the cables with a wooden mallet caused the snow to fall, and the cables returned to their normal positions.

The new line, with staggered conductors and greater spacing, was not short-circuited, and in fact there has been no disturbance on this line due to sleet.

The results obtained by staggering the conductors on the new Baltimore circuit have been so satisfactory, as already pointed out, that it was desired to stagger the conductors on the older line. This was accomplished without making any change to the crossarms by means of so-called "V-insulators," which the power company has recently installed on approximately every other suspension tower on its line No. 12. The arrangement is shown in Fig. 2. The old insulator strings were left intact, but the lower ends were pulled in from 2.5 to 3 ft. by means of new insulators. The new string forms a V with the old one, with the cable clamp at the apex. These insulators have been on the line only a few months, and hence have not been thoroughly tried out. It may be found necessary to pull over every suspension string, since with the V-insulators at only every other tower the intermediate old-style insulators are pulled in only a few inches.

With the electrical preventive measures outlined above, and improved mechanical design as a second line of defense, as it were, the Pennsylvania Water & Power Company hopes that the "irreducible minimum" of sleet damage has been attained. The mechanical and electrical tests described by the writer were carried out under the direction of A. Bang, testing engineer of the Pennsylvania Water & Power Company.

Characteristics of Standard Inclosed Fuses

Results of an Investigation of Suitable Construction Materials, Performance of Fuses Under Different Operating Conditions, and Effect of Size, Kind and Amount of Filler on Operation

BY WALTER ARTHUR

ONE of the earliest attempts at an automatic device for opening an electric circuit was the insertion of a piece of metal or an alloy with a high electrical resistance and a low melting point in the circuit. This device has been handed down and is still in use, in some instances, in its original form. The operation of such fuses as they were originally constructed was not reliable as in most instances it is necessary that an electric circuit with a definite current be opened in a very definite time This the ordinary fuse can not always be depended upon to do.

It has been found that the factors controlling the behavior of small fuses are as follows: (1) Material of fuse element; (2) shape of cross section of fuse element; (3) specific heat capacity of filler used; (4) heat conductivity of inclosing case; (5) length and diameter of case; (6) location of fuse element in the filler; (7) temperature of the atmosphere in which the fuse is used; (8) previous heat treatment of the fuse element and the effect of indicator wires.

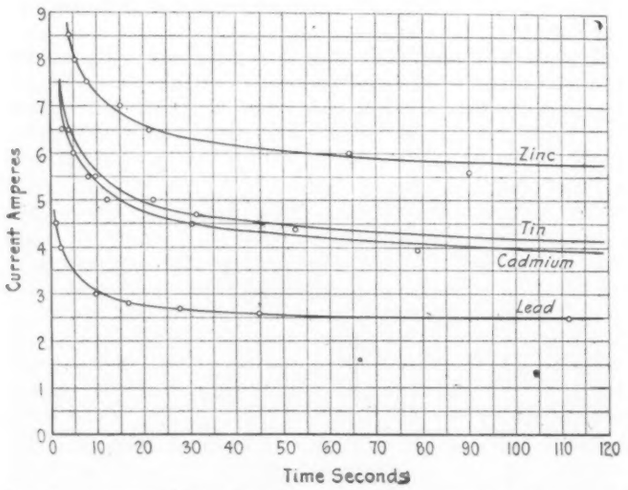


FIG. 1—CURVES (FROM TABLE I) SHOWING COMPARATIVE RATINGS OF FUSES MADE FROM ROUND WIRES 0.0125 IN. DIAMETER

The properties that must be considered in selecting a metal for the fusible element are: electrical resistance; tendency to oxidize, and the melting point. The only metals or alloys suitable for inclosed fuses are those of low melting point, since any metal melting at or near red heat would be required to dissipate heat when held at or near this temperature for any length of time, sufficient to char or burn the inclosing case unless the case be very large. The only metals melting below this temperature are: zinc, melting at 420 deg. C.; lead, melting at 327 deg. C.; cadmium, melting at 320 deg. C.; bismuth, melting at 268 deg. C., and tin, melting at 232

TABLE I—COMPARATIVE CAPACITIES OF INCLOSED FUSES MADE FROM ROUND WIRES

Wires—0.0125 in. diameter; filler—silicic acid; cases—fiber, length 1¼ in. external diameter, 0.5 in., internal diameter, ⅜ in., terminals brass.

Lead Wire		Zinc Wire		Tin Wire		Cadmium Wire	
Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.
4.5	4	8.5	4	6.5	4	6.5	2
					4		3
4.0	2	8.0	5				
	2		6	6.0	5	6.0	5
					5		5
3.5	3	7.5	8				
	3		9	5.5	9	5.5	7
			8		9		8
3.0	11		6		10		9
	10						
	8	7.0	14	5.0	20	5.0	11
	10		14		28		10
			11		23		11
2.8	17		11		17		16
	13		13				
	20			4.7	30	4.5	35
	16	6.5	21		30		30
	18		20		35		24
			22		30		32
2.7	33		28				30
	25		16	4.4	38		
	25				85	4.2	60
	28	6.0	83		40		100
			70		49		60
2.6	55		58				95
	42		52	4.2	135		
	45		60		100	3.9	270
	37				150		180
		5.6	120		110		275
2.5	107		60				195
	103		90				
	103		90				
	133		90				

deg. C. Any of these may be obtained in the form of wire by extrusion or by drawing. But tin, lead and bismuth must be extruded. Each of these metals except bismuth when in the form of wire is sufficiently pliable and possesses the mechanical strength necessary for working into serviceable fuse wire or ribbon.

Bismuth oxidizes quite easily indeed. The temperature at which it oxidizes is very much below its melting point, and when a wire is held at this temperature for any length of time the cross-section is very much decreased, thus increasing the resistance. The next of the metals in the order of their tendency to oxidize is lead. It does not oxidize as easily as bismuth, but the coating that may be formed is of sufficient strength to hold the metal in place when at a red heat. Frequently the current carried by a fuse wire under these conditions is many times the normal rating and breaks only when the lead completely oxidizes or reaches the boiling point. This behavior of the metal may considerably delay the time of blowing or breaking of the fuse. Zinc oxidizes quite easily when the temperature is near the melting point, but not as easily as lead or bismuth. This layer of oxide, like that formed on lead, often holds the metal in its original position until it reaches the boiling point.

The tendency of tin to oxidize is very slight indeed to within a few degrees of the melting point. When conditions are favorable a sufficient coating of the oxide will form on the surface to hold the metal in position until the temperature rises to a red heat. The range of temperature over which this oxide forms is so limited that only very rarely will the fuse element refuse to break at its normal rating.

Cadmium oxidizes but very slightly below the melting point. Its tendency in this direction is less than that of any of the metals mentioned. The amount of oxide formed is so very small that oxidation does not affect its reliability or its current carrying capacity.

The resistance of the metal composing the fusible element is one of the factors which enters into the choice of a metal for such purposes. The resistances usually given for the five low melting point metals given are:

Element	Specific Resistance in Micro-ohms per Centimeter Cube. Temp. 0 Deg. C.
Bismuth	108
Lead	18.5-19.5
Tin	9.5-11.5
Cadmium	6.0- 7.0
Zinc	5.5- 6.0

The resistance of the fusible element in large fuses is not so important but in low capacity fuses such as those below one ampere rating, it must be considered. A metal having a low specific resistance like zinc or cadmium is not suitable for fuses of this rating. A cadmium or zinc wire suitable for this rating would have a diameter less than 5 mils and this is too small to be practical. A lead wire of a convenient working size can be made which would carry 0.5 amp. but the tendency toward oxidation prohibits its use. Bismuth with its high specific resistance would seem ideal for this purpose but is too brittle and oxidizes too easily.

An alloy of bismuth and some of these low melting point metals, which would melt at a temperature below which either constituent would oxidize and have a fairly high resistance should, however, meet the requirements of a 0.5 amp. fuse. An alloy of 40 per cent lead and 60 per cent bismuth produces an alloy melting at about 125 deg. C. and has a resistance of 50 or 60 micro-ohms per centimeter cube. This alloy gives a material meeting the requirements of fuses but is impractical for large sizes. It possesses but little mechanical strength and requires a special low melting point solder.

By consulting Fig. 1 based on Table I it will be observed that fuses made from round lead and zinc wires occupy positions, relative to each other, such as might be predicted from their melting points and specific resistances. Lead, with a specific resistance of about 19 micro-ohms per centimeter cube and a melting point of 327 deg. C., should carry much less current than zinc having a specific resistance of about 6 micro-ohms per centimeter cube and a melting point of 420 deg. C.

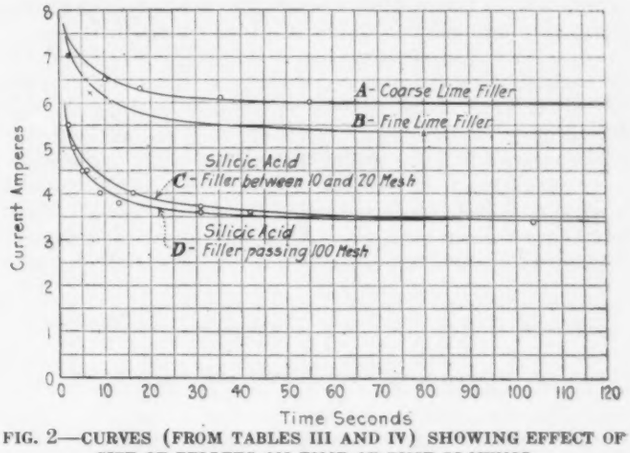


FIG. 2—CURVES (FROM TABLES III AND IV) SHOWING EFFECT OF SIZE OF PELLETS ON TIME OF FUSE BLOWING

Fuses made from tin wire having a specific resistance of about 10 micro-ohms per centimeter cube and a melting point of 232 deg. C. would be expected to carry less current than fuses made from the same size cadmium wire which has specific resistance of about 7 micro-ohms per centimeter cube and a melting point of 320 deg. C. By consulting the curves drawn from Table I, it is found, however, that fuses made from tin wire carry slightly more current than those from cadmium wire of the same size. The probable explanation is that tin and cadmium do not radiate heat at the same rate and that the resistances may not have been the same as given in the table.

TABLE II—DIFFERENCE IN REGULARITY DUE TO THE USE OF DIFFERENT FILLERS—CASES OF FIBER, 0.5 IN. x 1¼ IN.

Pellet-Lime Filler (10 per Cent Passing 20 Mesh) With 2x35 Mil Zinc Ribbon			Silicic Acid Filler With 2x50 Mil Zinc Ribbon		
Current in Amp.	Time in Sec.	Average Time in Sec.	Current in Amp.	Time in Sec.	Average Time in Sec.
7.0	2	2	8.0	3	3
				3	
6.5	7	6		3	
	5				
	7				
			7.0	7	7
				6	
6.0	11	15		7	
	18				
	19		6.0	18	16
	13			23	
	11			9	
	17			12	
				18	
5.8	60	44		16	
	18				
	35		5.5	42	38
	90			35	
	42			33	
	20			28	
				27	
5.7	55	44		37	
	55			50	
	30			43	
	45			65	
	35			22	
5.4	95	102	5.0	66	191
	65			60	
	150			90	
	130			120	
	85			360	
	90			450	

The shape of the cross-section of the fusible element in no way influences the carrying capacity, but does

exercise a decided influence upon the sensitiveness of the blowing or breaking of the element. When the element has a circular cross-section it may be, and sometimes is, held in place by a finely divided, closely packed filler, after the metal has become molten. If in the cross-section the width is much greater than the thickness, this tendency to "hold in place" is much lessened. Also a very thin element has a tendency, when molten, to contract to a circular cross-section. This contraction to a circular cross-section invariably results in the breaking of the element. This effect is so marked that the susceptibility to rapid fusing is quite noticeable.

In making a fuse element of this kind a suitable sized wire was rolled into a ribbon of 2 mils thickness. This thickness was selected because it was about the thinnest ribbon which could be handled with ease and dispatch

TABLE III—EFFECT OF SIZE OF LIME PELLETS ON TIME OF BLOWING
Wires—zinc, 10x22 mils; cases—fiber, 0.5 in.x1¼ in. No indicator wires.

Fine Lime Filler (10 per Cent Passing 20 Mesh)				Coarse Lime Filler (Between 10 and 20 Mesh)			
Current in Amp.	Time in Sec.	Average Time	Extreme Time	Current in Amp.	Time in Sec.	Average Time	Extreme Time
7.0	2 4	2	2 4	7.0	2	2	2
6.5	7 10 9 15	10	7 15	6.5	5 5 7	6	5 7
6.3	35 30 15 12 7 7	17	7 35	6.2	7 5 6 9 7 6	6	2 9
6.1	17 9 50 65 35	39	9 65	6.0	18 15 10 15 7	11	5 18
6.0	45 70 70 55 55 50	55	45 70 70	5.5	120 23 110	83	23 120
5.5	300 240 180	240	180 300				

and without injury to it. In attempting to secure a ribbon of less thickness difficulties in rolling are encountered. A ribbon thicker than 2 mils shows greater irregularities in its operations. A comparison of the time-blowing points of fuses made from round zinc wires and zinc ribbon and pellet-lime filler shows greater regularities in the blowing of the ribbon fuses.

Much of the variation in the time required for the ordinary fuse to open a circuit on an overload comes from the difference in specific heat capacity and heat conductivity of the various fillers used. In many standard fuses with zinc wires the ordinary pellet-lime filler is used. By an examination of these pellets quite a variation in size is observed which introduces a difference in heat capacity and conductivity. These differences give a wide variation in the time required to blow the fuses on an overload. This is well illustrated by comparing the regularity of the blowing points of fuses made with the ordinary pellet-lime filler and silicic acid filler. It may be observed by consulting Table II that fuses made from zinc ribbon (2 x 35 mils) and ordinary pellet-lime filler show less regularity in time of blowing than fuses made from zinc ribbon (2 x 50 mils) and silicic acid filler. The reason obviously is that the silicic acid filler being much lighter and more fluffy has a much more even heat conductance than the lime filler. At the same time the silicic acid filler has much less material in contact with the fuse element; thus the difference due to the variation of heat capacity of the filler is much less effective. The effect of heat capacity and heat conductivity of different sized pellets in the pellet-lime filler is shown in Table III and in Fig. 2 based on this table. Fuses made from fine pellets carry

TABLE IV—EFFECT OF USING SILICIC ACID FILLER OF DIFFERENT GRANULATIONS
Wire—2x35 mil cadmium ribbon: cases—fiber, 0.5 in.x1¼ in.

Silicic Acid Filler Between 20 and 40 Mesh			Silicic Acid Filler Passing 100 Mesh		
Current in Amp.	Time in Sec.	Average Time	Current in Amp.	Time in Sec.	Average Time
5.5	2 2	2	5.5	2	2
5.0	3 3	3	5.0	3 3	3
4.5	6 5 6	6	4.5	5 5 5	5
4.0	18 16 12 14 15	16	4.0	7 7 11 11	9
3.7	29 38 32 29 29 29	31	3.8	15 13 14 12	13
3.6	42 42 40 49 47 30	42	3.6	24 28 40 30	31
3.4	140 100 112 92 93 90	140	3.4	210 115 145 75 80	125

0.5 amp. less than those made from the coarse pellets. The differences in the time-blowing points of fuses made from different granulations of silicic acid is shown in Table IV, and in Fig. 2 the fuses containing

TABLE V—EFFECT OF VARYING THE AMOUNT OF FILLER
Ribbon—2x38 mil cadmium; filler—silicic acid; cases—fiber, 0.5 in.x1¼ in. Internal diameter, ⅜ in. exact.

Weights of Filler in Grams	Time in Seconds to Blow Fuse with 3.7 Amp.
0.700	20 Average time, 19 18 18
0.750	27 Average time, 26 26 25
0.800	27 Average time, 28 29 30
0.850	32 Average time, 29 27 28
0.900	27 Average time, 30 29 34
0.950	34 Average time, 33 31 33

the finer filler giving a curve with a much sharper angle and having a slightly lower carrying capacity.

The quantity of the filler, especially that of the silicic acid has a marked influence upon the time of blowing; due to the changes in the heat capacity and heat conductivity of the filler. In Table V is shown the effect of varying the amount of the filler.

The effect of the length, diameter and heat conductivity of the fuse case, location of fusible element and temperature of surrounding air will be discussed with other subjects in a later issue.

Rehabilitation Without Service Interruption

How a New 1800-Kw. Station Was Built on the Site of an Old Power-Plant Building and New Switching and Control Equipment Installed at a Cost of $35,000 with Data on the Unit Coal Consumption

THE electric light plant at Holland, Mich., has just been rehabilitated to give added surety of continuous service, to reduce fire plant hazard, to increase safety of operation and to provide for future growth. All of the changes, involving the construction of a new building and the installation of new electrical control equipment, were made under regular load conditions without a single interruption in service. The reconstruction plan was unusual in that no money was spent in an attempt to reduce the present operating costs of the plant, the entire effort being directed toward the improvement of the quality of the service rendered. On the other hand the over-all production cost was increased since the expenditures appreciably increased the overhead charges. The only reduction in expense was in the cost of insurance, which the plant now carries itself. All expenditures will be provided for from accumulated profits and no new money will be required for the improvement.

One of the largest engineering problems, probably, was to erect a new 82.5-ft. by 70.5 ft. building on the site of the existing station, leaving the boiler room intact for the present, but providing a plan for changing the boiler room layout within the next few years. Arrangements were also made so that the turbine room might be extended at a later date. Along with the task of "building over a building," so to speak, was the necessity of installing new buses and switching apparatus to reduce the fire hazard and make for greater safety of operation. Reliability of service was especially important, since the town is dependent upon this source of power for both its water and electricity.

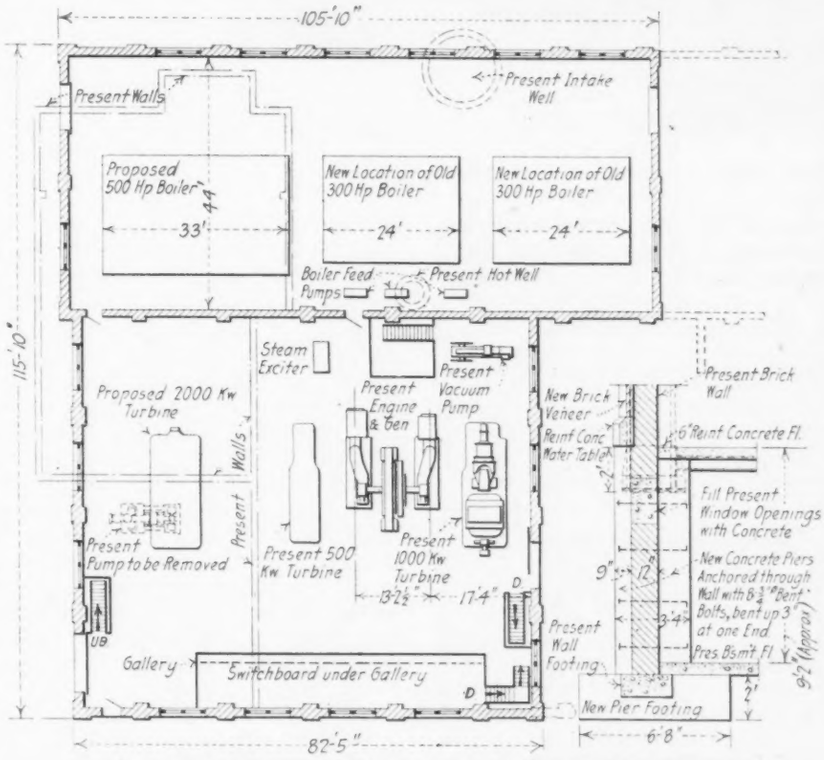


FIG. 1—LAYOUT OF NEW STATION WITH RESPECT TO THE OLD PLANT

HOW THE BUILDING PROBLEM WAS ATTACKED

The building which housed the plant just rehabilitated was a very old structure with 13-in. brick walls, a wooden main floor and a low wooden roof supported on wooden columns. The new building is a steel-frame structure faced with tapestry brick and equipped with metal windows and metal skylights. The roof is of concrete covered with tar and gravel. The steel columns in the wall of the building which will later be the partition between the turbine room and the yet unconstructed boiler room, were made sufficiently heavy to hold their share of the additional roof load and the overhead coal bunkers.

To minimize the excavating and other foundation expenses the existing 13-in. brick foundation was left intact and at such places as supports were needed for the columns of the new steel, framework footings, like those in Fig. 1, were installed. The placing of these column footings was accomplished by digging down 2 ft. on both sides of the existing foundation, drilling it for the reinforcing tie rods, setting the rods in place, building up the footing form and casting the concrete column footing in place. Eight of these column supports were used under the sides of the building, and seven similar footings under the ends to support pilasters for reinforcing the end walls. The new footings now carry the load of the entire steel frame, roof and walls of the building except that portion of the side walls which stands below the level of the original walls of the old building. The lower section of the side walls is carried by the old foundation, which now is really under a lesser load than it was in the old building. This treatment of the foundation, it is estimated, cost $5,000 less than a new foundation would have cost and the result is proving just as satisfactory as if new construction had been used throughout.

When the footings were in place portions of the old wall were torn away to give places for the steel columns. The entire steelwork and roof were then erected around and over the old building. A new roof was put on and a 15-ton traveling crane was erected between the old roof and the new roof. After a wood bulkhead had been placed inside the old walls to protect the machinery from the weather, the old walls were torn down and the new ones laid, that portion of the new side walls above the window tops being supported on steel lintels, which transmit the load to the columns. Almost the last step in tearing away the old building was removing its roof, which was left standing on wooden columns to protect the turbines and engine from the weather and material which might fall during the re-

construction. While the new concrete main floor was being laid the prime movers were operated from the old floor and from planks laid on the steel reinforcing which was later to support the concrete. The machine foundations were not changed.

In reconstructing the electrical control equipment the problem was considerably simplified by removing all of the old generating panels to one corner of the station and carrying bus wires out through a window to a temporary switch house, in which the old feeder panels had been erected. While the plant was operated in this manner the new generator leads, buses and switchboard were installed.

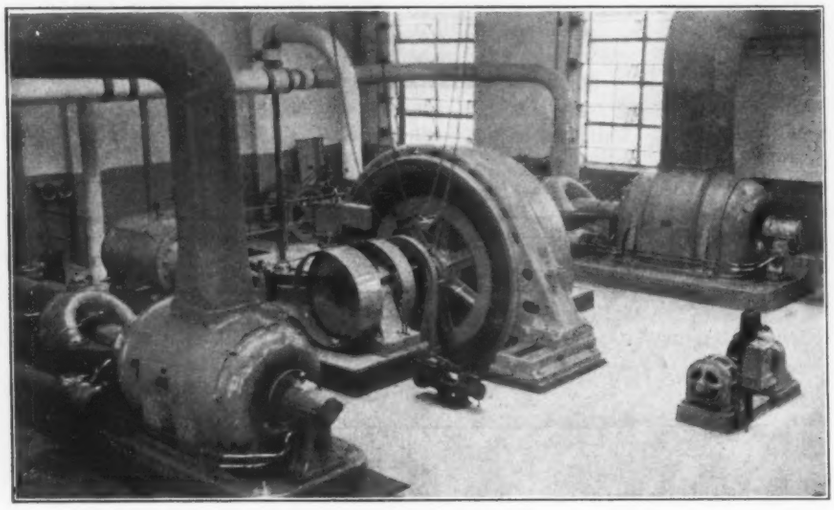


FIG. 2—ENGINE ROOM SHOWING FLUES FOR VENTILATING GENERATORS

The four-wire leads from the generators run directly to the buses in the basement, passing through disconnect switches. In the leads from two of the generators to the buses no automatic circuit-breakers are used. There is an automatic oil switch, however, in the circuit of the 1000-kw. generator, but the automatic feature is used only when paralleling, and after the machine is in synchronism the automatic control is cut out. Since the generator leads are placed in separate single-conductor fiber conduit, it is thought that there will be little if any chance for trouble between the busbars and the generators. Furthermore, the construction and secure location of the bus structure practically prevents the occurrence of short-circuit in this portion of the system unless one develops in the generators. The principal reason for placing all generator leads in fiber conduit is that the choking effect is less than with iron pipe.

Feeders connected with the buses pass through disconnect switches in the basement and from there rise, with each wire in a separate fiber pipe, to automatic oil switches equipped with inverse time-element relays. These units are set on the first floor and attached directly to the panels 24 in. apart. The relays are set to operate on 50 per cent overload in ten seconds. From the oil switches the lighting circuits run in iron pipes, with a single pipe to each circuit, to the gallery floor directly over the switchboard. One leg of each circuit passes through an automatic induction feeder regulator and then runs to the outgoing line rack, which carries the potential and secondary transformers, choke coils and spark-gap type lightning arresters. The automatic feeder regulators replace old-style step hand-operated regulators formerly used. Multiple conduit was used for leads near the generators and single pipes for single feeder circuits to eliminate as nearly as possible trouble that would affect the entire plant output.

Safety of operation was a ruling consideration in laying out the bus room in the basement. Instead of connecting the current transformers permanently in the generator leads they were supported below the station buses and connected therewith by disconnecting switches. Thus the transformers may be removed from the live part of the system for repairs whenever desired.

Tub-type regulators for the city lighting system have been placed inside a wire grating in the bus room. So that operators will not have to go inside the bus room to lift the tub weights each time the street lamps are lighted, however, 12-in. by 18-in. swinging doors have been placed in the grating so that the weights may be reached from outside the busroom.

TABLE I—THE COST OF THE IMPROVEMENTS AT HOLLAND (MICH.) STATION

Engineering and superintendence	$2,539.86
Exciter set, 12-kw. engine-driven and foundation	524.99
Building construction	17,151.69
Labor and material for all temporary work in connection with electrical apparatus	972.90
Conduit, labor and material	809.42
Bus structure (a.c. and d.c.)	1,284.02
New switchboard, feeder voltage regulators, generator cable and outgoing lines, labor and material	5,751.21
Plant-service conduit and wiring	1,097.65
Traveling crane (15-ton)	2,518.08
Rearranging atmospheric exhaust	127.23
Ventilating ducts for turbo-generators	391.12
Painting	1,057.45
Wall of bus room in basement	210.61
Motor-generator set bedplate, coupling and setting	79.76
Miscellaneous items	427.18
Total	$34,943.17

TABLE II—POUNDS OF COAL USED PER KILOWATT-HOUR IN PLANT AT HOLLAND, MICH.

	1913	1914	1915	1916
January	....	4.93	5.34	4.79
February	....	5.44	4.74	4.42
March	4.90	5.34	5.12	4.75
April	4.82	5.21	4.95	5.09
May	4.70	4.87	4.93	4.73
June	5.19	5.24	4.81	....
July	5.33	5.42	5.08	....
August	5.28	4.92	4.85	....
September	5.56	4.99	4.78	....
October	5.50	5.03	4.57	....
November	5.27	4.77	4.38	....
December	4.71	5.40	4.86	....

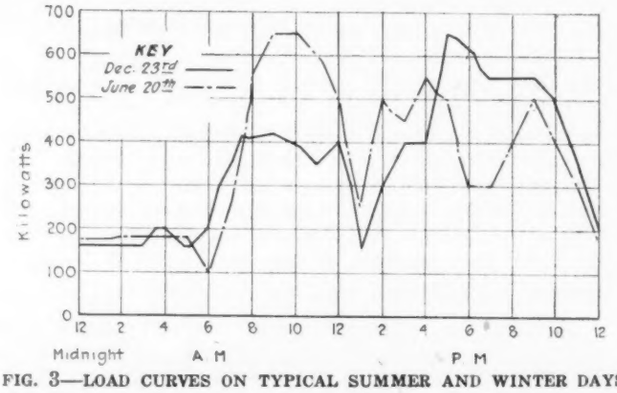


FIG. 3—LOAD CURVES ON TYPICAL SUMMER AND WINTER DAYS

The plans for the building at Holland were made by James N. Hatch, consulting engineer, of Chicago, and Clark, Jonkman & Clark of Holland were the building contractors. The reconstruction and electrical work was carried on under the direction of R. B. Champion, superintendent of public works.

INSTALLATION OF FIBER DUCT LINES IN CONCRETE

Features of Underground Concrete Conduit Construction When Using Fiber Duct and a Graphical Method of Determining Materials Required

Until quite recently underground transmission and distribution systems have been confined to the larger cities. There is at present considerable agitation by municipalities tending to require public utility corporations to resort to underground construction even in the smaller cities. Many city authorities now require an agreement whereby the electric lighting interests promise to spend either a predetermined amount of money in each municipality annually or to install a certain amount of conduits. From this it may be gathered that the scope of underground conduit construction is constantly widening. The rapidity with which the advantages of underground construction have been accepted has led to the adoption of numerous materials for the construction of conduit lines. Each of these materials has some peculiar advantage over the other, but all are manufactured with definite fundamental requirements in view.

The fundamental requirement of any conduit regardless of the material is protection to the cables it will contain. Allied with protection there should be durability and permanence. Protection is a broad term and covers many items. For instance, the duct should not be affected by the chemical elements in the soil, whether they be natural or due to the proximity of industrial plants. If a short-circuit should occur in one duct, the material should be fireproof so as not to permit the arc to communicate with the other cables. For the above and other electrical reasons the material should have a high insulating value. The material should withstand high-voltage tests when installed in wet soil and in service as well as in the preliminary tests. The duct should not be subject to corrosion or disintegration. The material should be moisture proof and offer protection against electrolysis. Aside from these physical requirements, the duct should be so manufactured as to permit facility of handling and installation, and also permit the ready installation and removal of cables.

Duct materials may be divided into three general classes, according to the material upon which they are

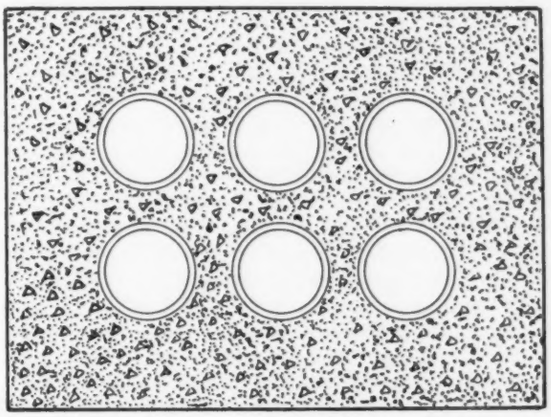


FIG. 1—SECTION OF CONCRETE CONDUIT LINE USING FIBER DUCT

based, as metals, vegetable and silicious materials. The first type, of which wrought-iron pipe is the best known, is rather expensive for main-line conduits, and is used generally for services between the distribution manholes and the consumers' premises. In the second class are fiber duct and creosoted-wood conduits. The fiber duct is rapidly advancing in favor in underground construction. The creosoted-wood conduit, known also as pump log, lacks durability, but at one time had an extensive use, the chief advantage being its low initial cost. In the third class are cement and stone conduits and vitrified clay or tile duct. In this latter class the tile duct finds the most extensive use.

Fiber duct possesses many advantages over the other

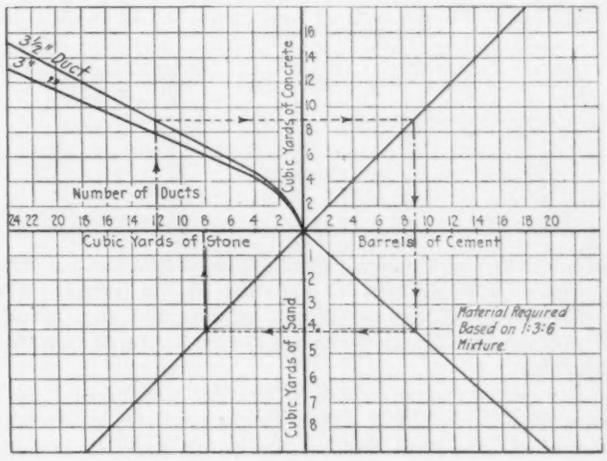


FIG. 2—DIAGRAM FOR DETERMINING MATERIAL REQUIRED FOR INSTALLATION OF CONDUIT USING 1 : 3 : 6 MIXTURE

forms of conduit materials. Recently it has been used in great quantities, supplanting other materials, and is increasing in popularity. Fiber duct consists of wet wood pulp or fiber which is wrapped about a mandrel in a thin film while under pressure. When built up to the proper thickness it is dried and then saturated with a bituminous compound. The conduit is manufactured with four general types of joints, the use and nature of which is implied in the name. These are the socket, the drive, the screw and the sleeve. The socket type is generally used with the concrete envelope, while the other types have no form of protection, being laid directly in the earth.

The advantage of light weight stands out primarily for fiber duct, and due to this the freight and cartage rates per foot are much lower than for other types of materials. Approximately three times as many duct feet of fiber duct may be carried in the same car as of tile duct. Likewise in handling the duct, one man can carry several lengths of fiber duct aggregating many lineal feet as opposed to one section of multiple tile duct. In installing the duct one man can remain in the trench and another hands him the duct, while with other materials it usually takes more than one man to handle the material at the top of the trench.

The breakage and waste is almost negligible with fiber duct, a distinct advantage being that broken pieces may be sawed off as if of wood and the good section trimmed up and used in piecing out the line. If a multiple tile is broken it means a loss of several duct feet and little use can be made of the remainder. As the sections are long a very good alignment can be secured with fiber duct without the use of mandrels. The length also means fewer joints and eliminates greatly the danger of particles of concrete sifting through and damaging the cable sheaths at some future time. Obstructions can be easily by-passed when in the path of the conduit line and when fiber duct is used.

In constructing conduit lines with fiber duct the construction is similar to that shown in the cross-section of Fig. 1. The ducts are separated by an inch of concrete and surrounded on the outside by an envelope 3 in. thick. The trench is dug with sufficient width to

allow the proper spacing and a 3-in. base of concrete is poured. The first tier of ducts is laid and held in place by a wooden rake designed to maintain the spacing. More concrete is poured and tamped into place and the second tier laid, and so forth, until the line is constructed. Between the tiers the joints are staggered, which tends to increase the strength of the finished line. The trench is dug according to the width of the line, so that no wooden forms are used and the concrete is poured and confined by the sides of the trench. The arrangement of the ducts in the line and the outside dimensions for 3.5-in. ducts are shown in the accompanying table.

Table I—Dimensions of Duct Lines Using 3.5 In. Fiber Ducts Arranged as Shown in Fig. 1.

Number of Ducts	Number of Ducts Wide	Number of Ducts High	Outside Width	Dimension, In., Height
4	4	1	25	10
6	3	2	20	15
9	3	3	20	20
12	4	3	25	20
16	4	4	25	25
20	4	5	25	30
24	4	6	25	35
30	6	5	35	30
36	6	6	35	35

The set of curves based on a 1:3:6 mixture for both 3-in. and 3.5-in. fiber ducts constructed as illustrated in Fig. 1 has been worked up by an Eastern central station company, and is used for estimating the material to be ordered for the job. For instance, for 100 trench feet of twelve 3.5-in. ducts there would be required 9 cu. yd. of concrete made up of nine barrels of cement, 4.2 cu. yd. of sand and 8.4 cu. yd. of stone.

A Quenched-Gap Method of Opening Heavy Alternating Current

Alternating-current switches are usually built so as to open the contacts wide and with high speed in order to get a reliable and quick extinction of the interruption arc, in the same way as it is usual with direct current.

In patent 1,212,125, issued to Walter Burstyn of Berlin, Germany, the same effect is secured by opening the contacts so slowly that their distance at the moment of the next minimum of the alternating current is very small not exceeding 2 mm. with a weak current; with stronger currents the distance is preferably chosen to equal about 0.5 mm. In this case the resulting interruption arc extinguishes in consequence of the quenching effect known with quenching gaps at the moment the current passes through zero. Immediately afterward the voltage is not able to jump the gap again. The same effect is also obtained if the contacts, initially, are not opened more than the critical distance.

There are several reasons why knife switches are not suitable for application according to the above theory. One reason is that a small opening distance of the contacts cannot be accurately adjusted. Another reason is that just at the moment of the break the electrodes of the switch form edges which on account of their small heat capacity, are considerably heated by the arc even if the latter is of short duration. In consequence they would soon burn away and necessitate a readjustment of the small gap required. Furthermore, they would reduce the quenching effect for which cold electrodes are a requirement. A third reason is that the quenching effect requires the arc to be inclosed, so far as possible, between two large metallic masses, which cannot be done by means of edges and points. That is the reason why plate spark gaps are used in wireless telegraphy as quenching spark gaps.

As a consequence of these considerations for automatic switches the invention proposes contact pieces of slight convexity.

THE PHASING-OUT OF AN UNDERGROUND SYSTEM

Methods Used to Identify Conductors and Properly Connect Seven Three-Phase Feeder Cables in a Substation

BY G. W. TEFFEAU, JR.

While reconstructing a substation which feeds the underground area in Los Angeles, Cal., it was necessary to transfer seven three-phase 2200-volt feeders from one end of the station to the other where a new bus and switching compartment was located. So as not to interrupt service the transfer was made with the cables energized, but while doing so the phase relations of the outside circuits to the station buses were lost. Since it is frequently necessary to balance the load on the transformer by changing the connections between the station buses and the transformer vaults, steps were taken to identify the conductors so connections could be made intelligently.

Attempts were therefore made to phase the circuits by connecting the primary of a 1-kw. transformer across one bus and ground at the station, closing the secondary through a bank of lamps. Then with another 1-kw. transformer similarly connected in the first transformer vault, it was hoped to complete the circuit through the ground and identify the conductor by the lamps going out when both transformers were connected to the same conductor. This scheme was found impracticable, however, due to the existence of so many electrical circuits underground in this district. For instance, there were three electric service companies, two telephone, two railway and two telegraph companies occupying the streets with their underground cables. Some carry 15,000, 2200, 440, 220 and 110 volts, alternating current, others 650, 500, 220 and 110 direct current, while the remainder are telephone and telegraph cables. On account of these conditions, the writer was detailed to "phase out" the 2200-volt cables and the problem was attacked as follows:

Since no loads were tapped off No. 1 feeder between the station and the first transformer vault and as the load was not balanced it was decided that the conductors could be easily identified by taking simultaneous readings of the current in the vault and at the cable entry in the station. It was unnecessary to carry the test on any circuit beyond the first vault as all the vault buses had been phased previously. This scheme of identifying conductors could not be used on any of the other circuits because there were several wiped taps between the station and the first vault in each case.

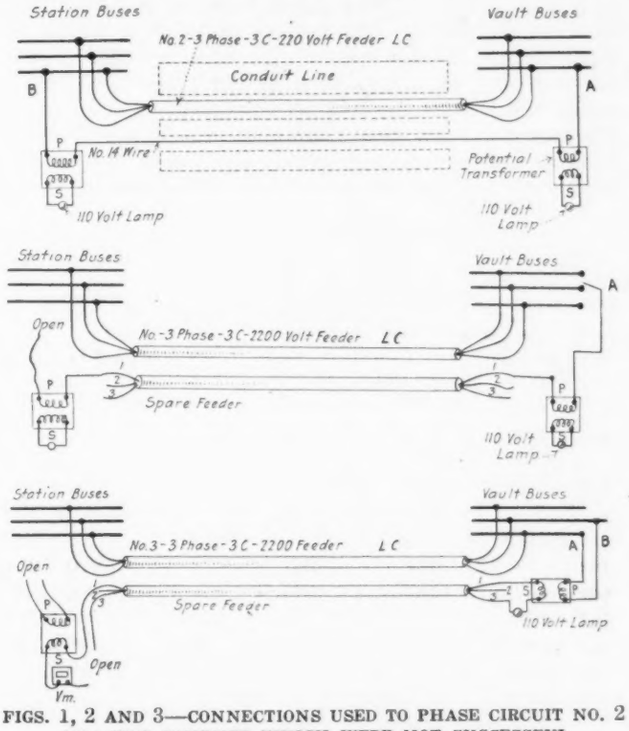
On circuit No. 2 a potential transformer was installed in the vault and one at the station, the primary windings of which were connected by a No. 14 wire. The remaining primary terminal of the vault transformer was connected with one bus and the remaining primary terminal of the station transformer was connected successively with the three conductors at the station. Since the secondaries of both potential transformers were closed through a 110-volt lamp, it was possible to tell when the vault and station transformers were connected to the same conductor as the lamps were then dark. By following this procedure each of the conductors was identified.

The same method was attempted on circuit No. 3 with the exception that one conductor of a spare three-conductor 4/0 lead-covered cable was used in place of the No. 14 wire. This was found impracticable, however, because the lamps across the potential transformer secondaries burned with normal brilliancy whenever either potential transformer primary was energized. As a second resort, two conductors of the spare cable were

connected with the secondaries of the potential transformers, placing the secondaries in parallel and a lamp and a voltmeter connected in series with the secondary circuit at the vault and station respectively. With these connections, however, the capacity of the cable was so great that the lamp at the vault attained full brilliancy as soon as the potential transformer primaries were connected to the buses. Upon testing the voltage between the conductors of the cable and ground at the station, it was found that the cable was picking up about 500 volts by induction. Yet, a 110-volt lamp connected across the conductors and ground showed no indication of current flowing.

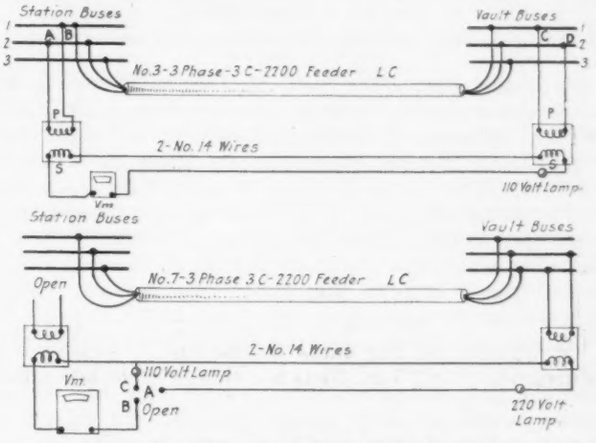
Having no success with this method, two No. 14 wires were pulled in the ducts to connect the secondaries of the transformer at the station and the transformer at the vault. A lamp and voltmeter were interposed in the secondaries at the vault and station respectively as before. With the primaries of the transformer at the vault connected to buses Nos. 1 and 2 and the primaries of the station transformer connected alternately to two of the buses at the station, it was an easy matter to change the connections at the station until a zero reading was obtained. This indicated that the test-set was connected to Nos. 1 and 2 buses at the station. It was then known that the station bus not connected to the test-set was feeding the conductor connected with No. 3 bus at the vault.

The lamp in the test set at the vault was for signaling purposes. A lamp could also have been used at the station in place of the voltmeter, but it would not have been as reliable because, when a zero reading was obtained by reversing the primary connections of the test set at the station, double potential was obtained supplying a check on the work. This method was continued with satisfactory results until attempts were made to test circuit No. 7.



FIGS. 1, 2 AND 3—CONNECTIONS USED TO PHASE CIRCUIT NO. 2 AND TWO SCHEMES WHICH WERE NOT SUCCESSFUL ON CIRCUIT NO. 3

For fear the signal lamp in the vault would burn out from the 220-volt flashes which it was subjected to, the men working in the vault substituted a 220-volt lamp before starting the test on circuit No. 7. When the primaries of the vault transformer were connected to buses No. 1 and 2 and before the transformer in the station was connected, the ends of the two secondary leads at the station were closed through a 110-volt lamp so as to indicate when the vault connections were complete. As no indication was given by the station lamp, investigation was made and it was found that the lamp in series with the secondaries at the vault was burning



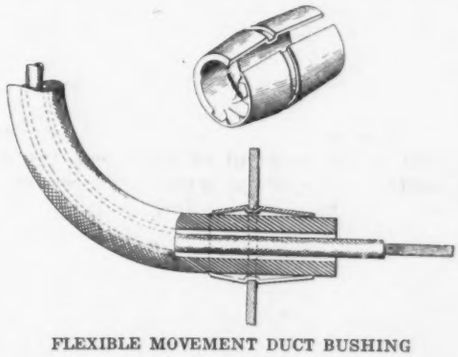
FIGS. 4 AND 5—IDENTIFICATION METHODS THAT PROVED SUCCESSFUL ON CIRCUITS NOS. 3, 4, 5, 6 AND 7

at about half candle power. At this time, the substitution of the 220-volt lamp was discovered. The lamp at the station end was removed, but the lamp in the vault still burned. The latter, which was the 220-volt lamp, was replaced by a 110-volt lamp, but this would not burn either, although voltage readings across the secondaries showed 125 volts. When the secondary of the transformer at the station was connected, however, the circuit was phased without further difficulty.

It may be of interest to state that to date there has been no reason discovered for the 220-volt lamp burning when the 110-volt lamp would not. Careful tests were made to make sure that no grounds or short-circuits existed in the secondaries of the test set.

Flexible Duct Bushing for Cut-Out Boxes

An exceedingly simple and easily applied bushing that will facilitate attaching a flexible woven conduit to an outlet box is the subject of patent No. 1,204,625, issued to Carl M. Wheelock, of Milwaukee, Wis. The device is made in one piece, formed from sheet metal and split along one side. Its diameter is such that it will fit snugly around the "circular loom" or other flexible tubing. Around the periphery of the bushing near the middle are a number of sharp points or teeth which grip the tubing and prevent it from slipping longitudinally. To place the bushing in position, it is slipped over the tubing to the proper point and then pushed in the entrance to the outlet box.



FLEXIBLE MOVEMENT DUCT BUSHING

OPERATING HYDROELECTRIC PLANTS TO BEST ADVANTAGE

How a Graphical Study of Hydraulic Conditions Has Permitted a Wisconsin Company to Operate Its Hydroelectric Plant and Steam Reserve to the Best Advantage

BY W. J. WADSWORTH

Chief Operator of High Falls Station, Wisconsin Public Service Company.

Hydraulic data have been plotted, as shown in the three accompanying curves, by the Wisconsin Public Service Company to determine how to make the best possible use of pond storage at its High Falls station (Crivitz, Wis.) with the least possible help from auxiliary steam stations. The first winter these curves were used the head water was drawn down to 77 ft. (85 ft. being maximum elevation and 65 ft. the minimum) before steam reserve was called into service. When this assistance was secured the head water raised. To determine when steam reserve should be dispensed with a second curve was drawn. From records it was found that the first effects of spring water (rain and melted snow) would probably be felt between the middle of March and the first of April. In order to allow for possible trouble with the steam plant it was considered advisable to draw the head water down to only 70 ft. so as to allow 5 ft. for emergencies. If the hydroelectric plant had to carry the entire load, this 5 ft. of water would last about five days, thus affording a reasonable period for getting the steam plant in operation.

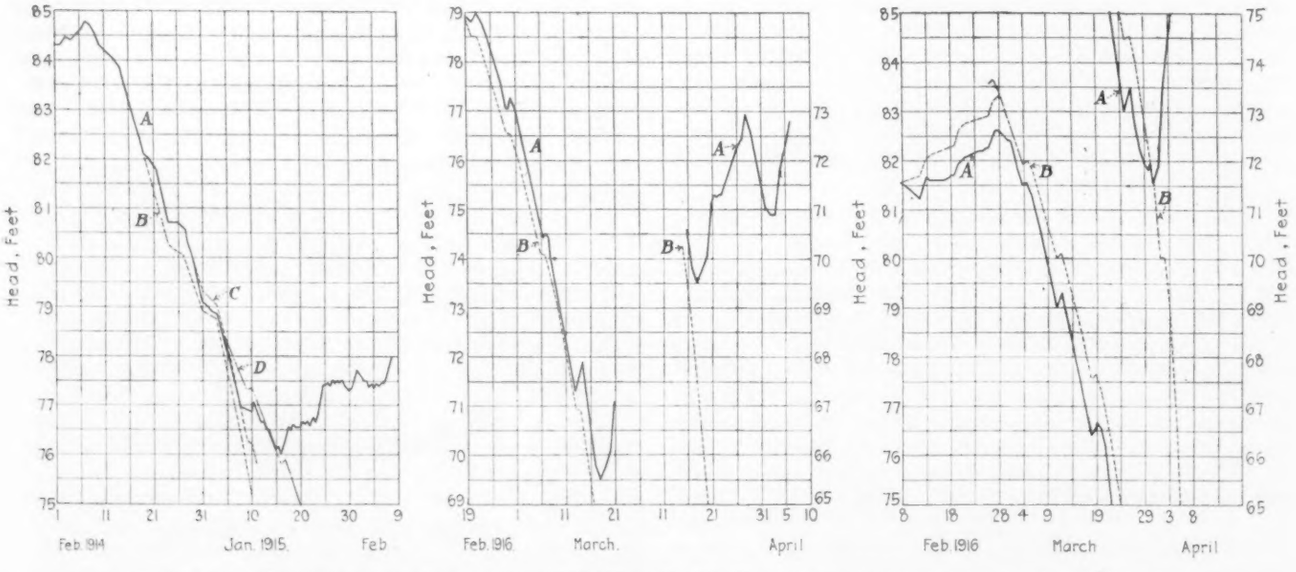
The predicted curve was based on the assumption that the steam reserve would be shut down on Feb. 19. The steam plant actually ran one day longer, however. Considering this difference, which has the effect of shifting the predicted curve one day to the right, it will be found that the predicted curve is remarkably close to the actual head-water readings. Spring conditions were not obtained until later than usual, so the steam reserve had to be employed from March 18 to 27.

Following this experience it was realized that steam reserve was being used at the wrong end of the winter because it would take less steam to hold the head constant or make it increase during the higher heads than during the lower heads. Consequently during the winter of 1915-1916 the curve was started differently. A very dry fall necessitated employing steam earlier than usual. A curve was drawn on Feb. 8 predicting heads with the steam plant carrying 1200 kw., which gave the best operating conditions. It was assumed that 70 ft. of head water would be required on April 1, so a curve was drawn beginning with this date and plotting backward. This showed the probable head for each day with the entire load on the hydroelectric plant. Where these two curves cross steam should be shut down. Actually, however, steam was shut down shortly before this date, but the curve of actual heads runs parallel to the predicted heads until rains occurred, which was during the last few days of March. Two years' experience has indicated that this method of analysis is quite accurate.

Arc Electrodes for Indicating Movement From Focus

When it is necessary to keep an electric arc fixed in position as, for instance, in connection with locomotive headlights where it is essential that the arc remain at the focal point, it is desirable to use one electrode, which is consumed very slowly by the arc.

Charles W. Dake of Chicago, Ill., assignor to the Pyle-National Electric Head Light Company, also of Chicago, has obtained a patent (No. 1,212,610) on an improved type of negative electrode, which notifies the operator by changing the color of the arc and subsequently by extinguishing the arc. The negative electrode is made of a cylindrical shank terminating in an expanded conical head which has a base that holds it in a fixed position. The shank together with the head is cored or drilled. The bottom of the hole which extends almost to the apex of the cone contains a conducting plug of metal, such as lithium or strontium, which will change the color of the arc when acted on by the open arc. An insulating plug of asbestos or other suitable material is provided so that when the arc has consumed the plug the arc will be extinguished.



FIGS. 1, 2 AND 3—HEAD-WATER READINGS AT HIGH FALLS STATION OF WISCONSIN PUBLIC SERVICE COMPANY

In Fig. 1, curve *A* refers to actual head readings, curve *B* to heads predicted for Dec. 19, with entire load on station, curve *C* to heads predicted for Dec. 28 under the same conditions, curve *D* to predicted heads for Dec. 28, assuming that the steam station would carry 500 kw. after noon of Jan. 5. The steam reserve started on Jan. 8 and carried 500 kw. until Jan. 18, after which 1000 kw. was carried. In Fig. 2 curve *A* refers to actual head readings, and curve *B* to predicted heads for Feb. 19, assuming all steam reserve is shut down at midnight of the same date. Steam reserve was actually shut down at midnight of Feb. 20 and started again on March 18, carrying about 600 kw. until March 27. Rainstorms occurred on April 4, 5 and 6. In Fig. 3, curve *A* refers again to actual head readings, and curve *B* to predicted heads, assuming 70-ft. elevation is to be obtained by April 1. The steam reserve carried about 1200 kw. until Feb. 29 and then 600 kw. until March 2. In predicting the head-water readings it was planned to shut the steam reserve down on the day that the two curves crossed (about Feb. 25).

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Transformer Alarm System Used by Connecticut Power Company

Transformers constitute one part of a central station's equipment whose service cannot be readily supplemented when trouble develops, so provisions have been made by the Connecticut Power Company in its Falls Village (Conn.) plant to automatically indicate excessive transformers temperature or interruptions of cooling-water circulation. With these arrangement, undesirable operating conditions can often be called to the attention of the station attendants in time to be corrected before serious damage and possible service interruption can occur. Low oil level can also be indicated by making simple connections if this additional pre-

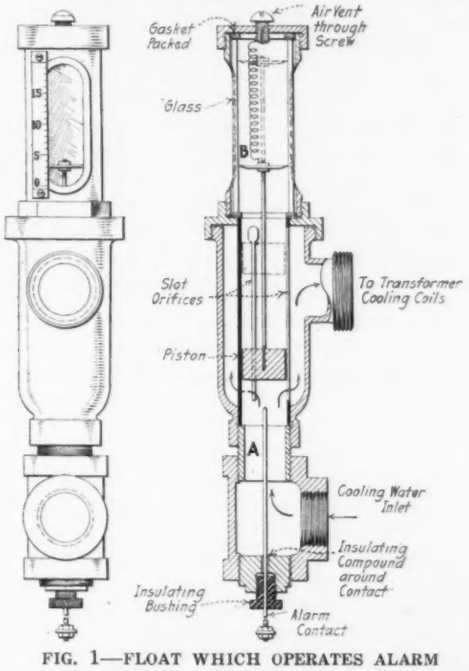


FIG. 1—FLOAT WHICH OPERATES ALARM

caution is ever found necessary. The alarm system consists of a dial-type thermometer and a flow indicator on each transformer so connected with an annunciator and an alarm bell that dangerous conditions in any transformer will ring the bell and indicate on the annunciator the particular bank in trouble.

As shown, the flow indicator consists of a movable contactor attached to a piston which slides in a slotted cylinder. The lower end of the cylinder is open to the incoming cooling water and the chamber around it discharges into the transformer cooling coils. Connections are made with the indicator at the top and bottom. The upper terminal connects with the body of the indicator and the piston through contact with the cylinder. The lower terminal is adjustable in position and consists of an insulated spindle extending up to the bottom of the piston cylinder. When water is circulating properly it forces the piston upward away from the lower contact until the slotted apertures are exposed enough to allow water to flow to the cooling coils. Thus, the higher the rate of flow the higher the piston will be forced, its position being indicated on the scale attached to the flow indicator. Gradual clogging of the coils would reduce the flow and cause the piston to drop in proportion to the obstruction presented to flow. Complete interruption of circulation caused either by stoppage of the coils or failure of cooling water supply will allow the piston to drop to the extreme lower end of its travel where it will make contact with the spindle ter-

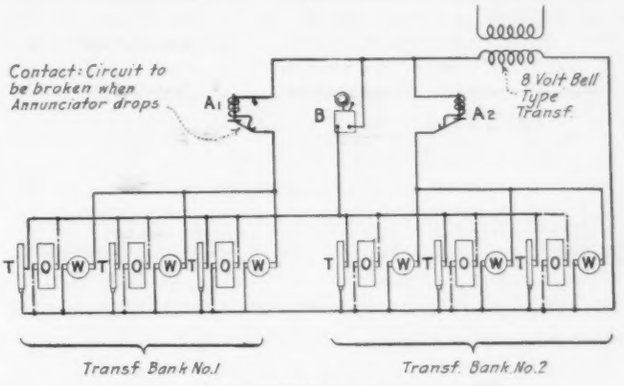
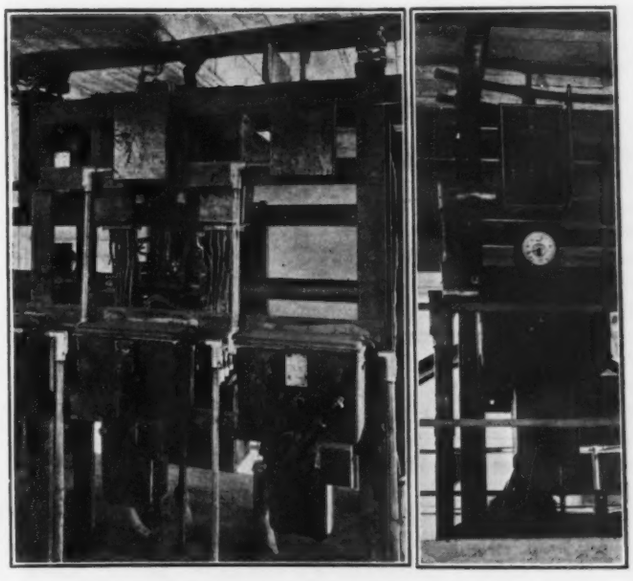


FIG. 2—CONNECTIONS IN ALARM CIRCUIT

minal. By raising the spindle terminal the alarm can be made to ring with partial stoppage of water circulation. While a battery was used with the alarm at first, so much electrolysis occurred in the flow indicator that a bell-ringing transformer was substituted. The flow indicator was developed by Mr. Vaughn of the Stone & Webster Engineering Corporation.

Arrangement of Compensators in an Oregon Cement Mill

Starting compensators for each department in the plant of the Oregon Portland Cement Company at Oswego, Ore., are grouped on structural steel frame-



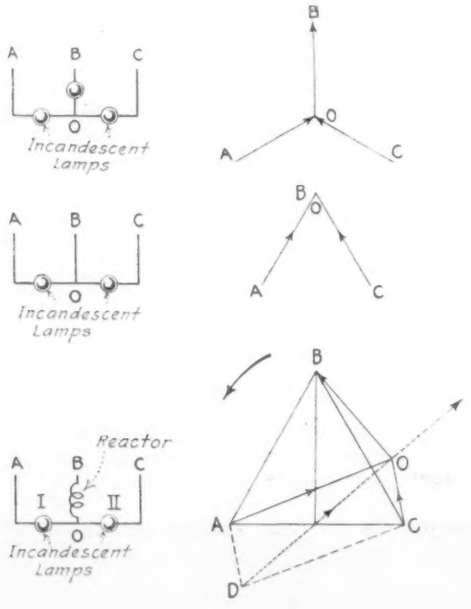
GROUP MOUNTING OF CEMENT-MILL COMPENSATORS

works, as shown in the accompanying halftone illustration. Energy delivered to them is carried by single-conductor cables supported horizontally above them on groove-top pin-type insulators attached to channel irons. From these busbars taps are taken off above each switch and connected to three-blade knife switches inclosed by sheet-metal cabinets. Conduits are provided for the circuits between the disconnecting switches and the compensators and between the latter and their respective motors. The compensators are of the Westinghouse dust-proof type, with ammeters for all circuits serving motors rated at 75 hp. or more. Control circuits consisting of No. 14 duplex cable are run from each compensator low-voltage release coil to the corresponding motor and there connected with a 600-volt snap switch so that men in the plant can stop motors in an emergency without going to the compensators. D. C. Findlay is the electrical and mechanical engineer.

Simple Method of Determining Phase Rotation

BY T. W. VARLEY

By connecting two incandescent lamps and a reactor (or condenser) in star, the phase rotation of any two or three-phase system can be readily determined by observing the relative brilliancies of the lamps. For



EFFECT OF REACTANCE ON Y VOLTAGES

example, if the lamps and reactor are connected with a three-phase system, as shown herewith, relative dimming of lamp II will indicate that the phase rotation is counter-clockwise, whereas reduction in relative brilliancy of lamp I indicates that the rotation is clockwise. If a condenser is used in place of a reactor, dimming of lamp I will indicate opposite rotation from that shown if the same lamp dims with a reactor in circuit. Where phase rotation has to be determined frequently, as may be the case where considerable reconnection of cable and overhead systems is required, or when numerous motors or transformers must be connected, it may be advisable to mount the lamps and reactors in permanent form.

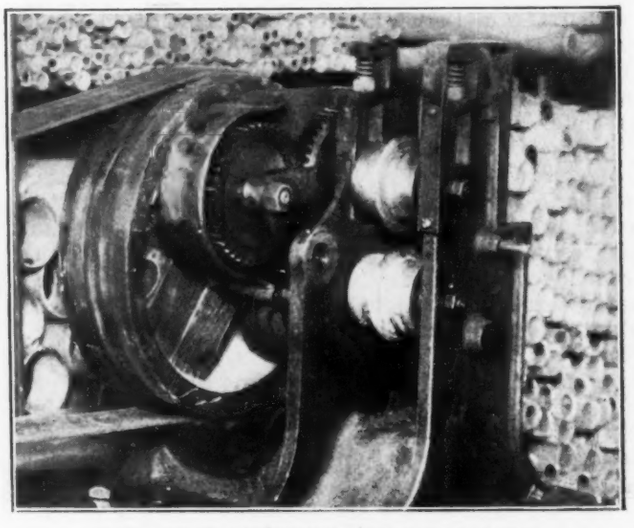
The action of the indicator can be explained by considering the voltage vector relations. For instance, suppose three equal resistances are connected in star, then the vectors will be equal and will fall 120 deg. apart as shown. If the resistance of one circuit is reduced the vector representing the voltage across the reduced resistance will shorten, allowing the other vectors to lengthen, thereby decreasing the angle between the last mentioned vectors. Under the extreme conditions of no resistance in one leg of the star the vectors *Ao* and *CO* will assume the positions shown, which is an open-delta connection. However, if a reactance is inserted in one leg of the star and plain resistance, such as incandescent lamps, connected in the other legs, the intersection of the vectors will not fall on a median. On the other hand, the locus will be a circle whose diameter lies along a medium of the triangle *A, B, C*. Thus the voltage across one lamp will be increased while that across the other is reduced. The portion of the circle which the intersection of the vectors will follow, and consequently the relative brilliancy of the lamps, depends on the phase rotation.

To show that dimming of lamp II indicates a counter-clockwise phase rotation, and that reduction in brilliancy of lamp I indicates the opposite, consider the lower diagram showing the voltage relation with lamp II dimmer than lamp I. Since the incandescent lamps are non-inductive their currents will be in phase with the potentials across them and proportional thereto. Consequently vectors *AO* and *CO* may represent the current relations also. The resultant of these currents will extend in the direction *DO*, and will be the same as the current through the reactors. *OB* which represents the potential across the reactor is perpendicular to *DO* since it is due principally to reactance. According to fundamental laws the voltage across a reactor always leads the current, therefore the phase rotation will have to be in the direction indicated by the arrow to satisfy this condition. The converse can be proved in a similar manner, the same reasoning applying to two-phase circuits.

Utilization of Scrap Cable

BY K. C. CAMPBELL

To command the highest market price for its scrap cable, the Detroit Edison Company has installed in its stores department apparatus for removing all insulation from cables. The scrap cable is first passed through a motor-driven cutoff machine used for cutting the cable into lengths convenient for stripping and burning to remove insulation. The cutting-off machine makes a clean cut without flattening the cable. The stripping machine, which is motor driven, has two rollers with



MACHINE FOR STRIPPING INSULATED CABLE

circular cutters, which force the cable through the machine and at the same time cut the lead and the overall covering of insulation lengthwise in two pieces. The lead is then ready for sale. The conductors are reclaimed by burning their individual insulations off in a furnace. The draft from this furnace is so regulated that the metal is not subjected to temperature which would fuse or weld the copper together. This furnace is also used for burning the insulation from weatherproof wire. After the copper is removed from the furnace it is baled in bundles weighing about 300 lb.

Cleaning Turbine Blades and Condenser Tubes

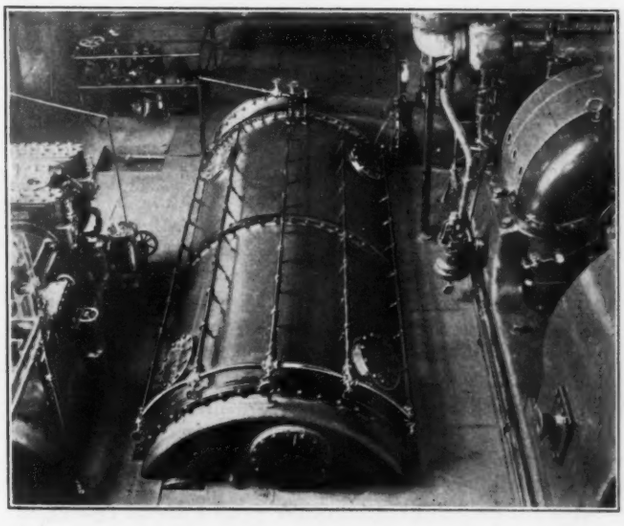
BY F. C. CHAMBERS

Mechanical and Electrical Engineer Des Moines City Railway Company.

Exhaust steam from two 1000-kw. reciprocating engines is being utilized to operate a 2000-kw. mixed-pressure turbine at the power station of the Des Moines (Iowa) City Railway. Since considerable suspended oil is carried over in the exhaust steam, means had to be provided for removing the deposit and scale formed on the turbine blades and tubes of the surface condenser used with the mixed-pressure unit. Arrangements have been made as follows:

A 2-in. pipe was installed to connect the circulating pump with a 2-in. header at one end of the condenser. From this head five pipes, tapering from 2 in. to 0.75 in in diameter, were connected across the section of the condenser above the turbine room floor, as shown in the photograph. Each pipe was tapped into the condenser through nine small bore pipes. About every three months, when a machine is shut down, the hot well is pumped dry and a barrel of kerosene oil dumped into the handhole in the condenser. The discharge pipe on the hot-well pump leading to the heaters is closed and the valve in the pipe leading up to the header over the condenser opened. The hot-well pump is then used to force the kerosene from the hot well through the spray nozzles. The circulation is continued for two to three hours and the kerosene then drained off and the deposit allowed to settle. The light oil, which rises to the top, is drawn off for treating the turbine.

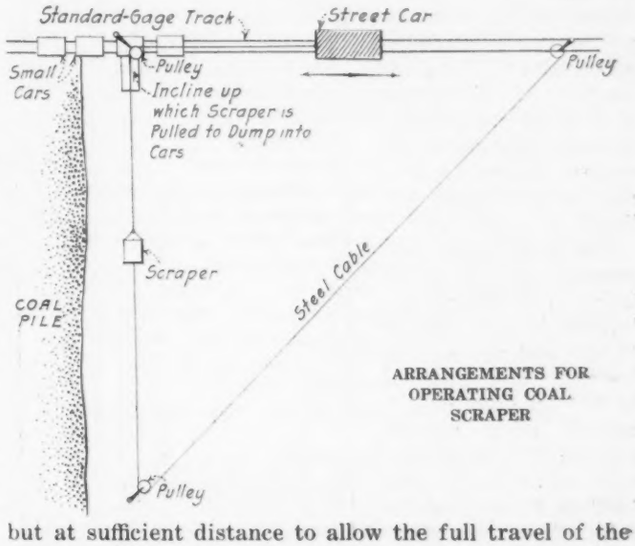
The kerosene treatment is given to the turbine in 50-gal. quantities once a week through a 0.75-in. pipe with numerous needle-point holes in it. This pipe is inserted across the steam intake pipe. Since the kerosene is carried into the condenser with the steam it helps to keep the tubes free of deposit. This procedure, supplemented by the thorough cleaning of the condenser every three months, keeps the turbine and condenser in good condition. Determination of the condenser condition is made frequently by means of the vacuum gage, which is connected so that it may be made to read the pressure at the intake and outlets separately, the difference giving a good indication of the condition of the condensing surfaces when compared with the same reading taken when the tubes are clean.



ARRANGEMENTS FOR SPRAYING KEROSENE ON CONDENSER TUBES

Transferring Coal from Storage to Dump Cars

At the power station in Moline, Ill., an old street car furnishes the power to load coal from the yards onto small dump cars. A scraper is used to drag the coal from the pile up a roughly constructed incline, from which it dumps its contents into the cars on the track. A steel cable fastened to the scraper runs over a pulley at the head of the incline and then parallel to the track to the street car. A return cable from the front of the car runs over another pulley directly in front of the car,



ARRANGEMENTS FOR OPERATING COAL SCRAPER

but at sufficient distance to allow the full travel of the scraper, then back over another pulley placed on a line with the scraper and the incline, and is finally fastened to the scraper. On backing up, the car pulls the scraper back and on reversing its direction the scraper is filled and pulled up the incline. The accompanying illustration indicates how the equipment is utilized.

A Scheme for Preventing Overloading of Patrol Telephone Lines

BY J. W. SWAREN

A novel arrangement is employed by the Pacific Power & Light Company on its telephone line along the Naches Canal to prevent overloading the line. A telephone instrument is mounted in a small wood cabinet at each mile pole. The service leads terminate at one pair of terminals of a single-throw, double-pole, "baby" knife-switch, and the instrument is connected to the other terminals. This switch is mounted on the inside of the cabinet in such a position that a wood lug fastened to the cabinet door strikes the handle when closed, thus cutting the telephone off the line. This simple arrangement, which was devised by J. H. Siegfried, superintendent of power of this company, effectually prevents a common fault of patrol lines, that of leaving the telephones in circuit.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SELLING RANGES IN SMALL TOWNS SYSTEMATICALLY

Experience with Three-Cent Rate, Thirty-Day Free Trial, Installment Payment Plan in Small Pennsylvania Villages

Last spring the Northwestern Electric Service Company, Erie, Pa., entered upon its first campaign and experience in the sale of electric ranges.

A rate of 3 cents per kilowatt-hour for cooking and heating, with a minimum charge of $1 per month, subject to a discount of 5 per cent for prompt payment, was established and the sales department authorized to get results. With some qualms of conscience and many misgivings, an order was placed for twelve ranges, and a plan of procedure outlined.

APPROACHED 7/5/1916						
Name	Address	Commodity	Got Attention	Got Interested	Got Chance to Close	Secured Order
1 W.R. Murphy	Mail	Range	1	1	0	0
2 Walter Armour	"	"	1	1	1	1
3 A.W. Purdue	"	"	1	0	0	0
4 J.W. Morse	"	"	1	1	0	0
5. W.S. Munson	"	"	1	0	0	0
6 J.B. Long	"	"	1	1	1	1
7 A.O. Zimmer	"	"	1	1	0	0
8 L.F. Betts	"	"	1	1	1	0
9 A.B. Miller	"	"	1	1	1	1
10						
11			9	7	4	3
12						
13						
14						
15						
16						
17						
18						
19						
20						
Total						
Per Cent						

SALESMAN'S SCORE CARD

The Northwestern company serves a population of 18,850 people, located in one city of 15,000 and six smaller towns. The city of 15,000 population is served with natural gas at the very low rate of 30 cents per 1000 cu. ft., so that the sales effort, as a starter, was devoted almost entirely to the smaller towns, which were using coal, wood, oil and gasoline with which to cook.

The range manufacturer kindly shipped us four ranges, and a systematic campaign of our customers was started. Two salesmen were delegated to proceed in a follow-up on a form letter, which was mailed to twenty customers each day. This letter spoke of the experience of other central stations with ranges, and offered a free trial of thirty days of any range to which the customer might take a fancy. In the follow-up work, two cards were used, which have proved very effective.

Reproduced herewith is the score card which the salesmen used. The salesmen were required to keep a record of each approach made, showing for each whether or not the salesman succeeded in getting the prospect's attention; whether he succeeded in getting her interested in the range after her attention was secured; whether he got a chance to "close" with the prospect; and whether he secured the order. This card helped the salesman to note his weak points, so that he could strengthen his argument at this particular point of the interview.

Another form used was a plain white card, 3 in. by 5 in., on which was typewritten the prospect's name, address, date, and appliance to be sold. Ten of these cards were mailed to each salesman each day, and on the same day that the form letters were mailed to corresponding prospects. As the prospects were called upon, salesmen noted results and future prospects on the white card and also showed his record on the score card, which he retained and, with the sales manager, picked out the flaws in his arguments. The white card when filled in, was returned to the tickler file in the sales office.

The four ranges on hand were sold in the first week's effort and a good many more promised, but as other central stations experienced at that time, delivery was slow and material hard to get. Six more ranges were ordered immediately and we are now merely selling electric cooking and recommending the best range that we feel our customer can afford to buy.

Our proposition to the customer was, any range selected to be sold, installed free in the home at list price, payable, $5 down and the balance in twelve equal monthly payments. Results were so good that we have now invaded our "city of 30-cent gas," and the year 1917 will prove a big year in electric cooking alone, for our present range owners have been requested for letters of recommendation and have, with very few exceptions, complied and are all "boosters."

On April 1 of this year, a big demonstration will be put on in every town we serve and no fear is felt as to the results, for electric cooking is here to stay.

RELATION OF UTILITY INCOME TO INVESTMENT

Why Gross Profit Must Be Such a Large Percentage of Gross Earnings Told in a Way That Public Can Understand

A little knowledge is a dangerous thing and particularly is this true of the general public. Rate investigations are many and costly and can as a rule be laid to the door of a little knowledge on the part of the consumers. The relation of gross profits to investment is pretty generally known for the ordinary retail business and there is no hesitation on the part of the public in thinking that the same relation is true of an electric lighting business.

A comparison of the relative investments, income and expense in the central station industry and in ordinary mercantile businesses was presented by T. K. Jackson, president and manager of the Mobile (Ala.) Electric Company, before the Mobile Rotary Club in the following words, which the public has no difficulty in understanding.

"Our business, on its face, is a pretty good business. Our operating expense is about 50 per cent of our income. This sounds pretty good. I dare say that there are very few mercantile enterprises whose income shows as great a per cent of profit as those figures would indicate, but there is a fly in our ointment.

"In fact, we have quite a few flies in our ointment. When we made 50 per cent net profit on the gross volume of our business we earned only 8 per cent on our investment, as our gross income—and I speak rather in this instance of average figures of all utility companies

than of our own company—is less than one-sixth of our capital investment. In other words, we invest more than $6 for every dollar of gross income, and, therefore, if our net profit is one-half of our gross income our net profit is one-twelfth of our investment, which is 8 1/3 per cent. In practically every line of business, with the exception of the public utility businesses, the volume of business done is very greatly in excess of the investment. So, a grocery store with an investment of $5,000 reasonably expects to do six times that volume of gross business, and if the grocery store makes 2 per cent on its gross sales it earns 12 per cent. * * *

"A retail dry goods company or a retail shoe store expects to turn its capital approximately four times a year, or, in other words, its volume of gross business is four times as great as its capital invested; therefore, if a shoe store or dry goods store makes a profit of 2 per cent on its sales, it is equivalent to our company earning 50 per cent on its sales. I think that a large part of the adverse legislation which has beset public utility companies in the past, but which is no longer besetting them, has been due to the failure of the legislators to understand the disparity between the volume of business done and the investment of public utility companies as compared with other normal merchandising or manufacturing enterprises. * * *

"It is essential that a public utility company, in order successfully to conduct its business, should conduct it at a profit. Otherwise plants are not maintained, capital is not available for new expenditures, and service suffers with even greater loss to the community served than to the company serving. * * *"

MOVIE DEMONSTRATION OF ELECTRIC FIRE TRUCKS

Electric Vehicle Section, N.E.L.A., Has Co-operated with Manufacturers to Produce Film Showing Apparatus in Service

The Electric Vehicle Section of the National Electric Light Association, with the co-operation of the Commercial Truck Company of America and the Electric Storage Battery of Philadelphia, has developed a motion-picture film showing modern electric fire apparatus in service runs responding to alarms, ascending steep hills, threading traffic jams, and returning to the engine house.

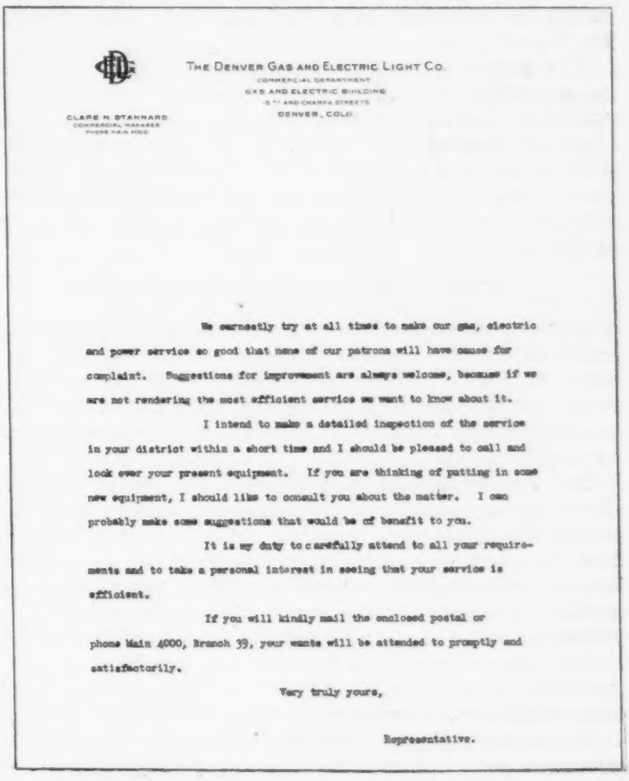
One of the chief claims for the battery-driven fire truck is the facility with which congested city traffic can be penetrated, owing to the rapid acceleration and complete control of the truck, and an interesting section of the new film, reproduced herewith, shows the electric fire apparatus speeding through an ordinary street jam that might have blocked less facile vehicles. Several striking tests of the hill-climbing ability of electric trucks are also shown.

The Electric Vehicle Section, N. E. L. A., is arranging to loan the film to central stations and others who desire to demonstrate to their local publics or officials the possibilities of the electric truck in fire department and other branches of municipal service.

THE DENVER COMPANY'S "GOOD SERVICE" DEPARTMENT

Appointment of "Supervisors" to Canvass Customers' Installations, Suggest Improvements and Forestall Complaints

Experience in more than one community has demonstrated that "service" work on the part of the central station pays in commercial results as well as in public good will. In fact, according to C. N. Stannard, commercial manager of the Denver Gas & Electric Light Company, each dollar spent in service improvement for the customer has brought a return of $3 to the company.



THE DENVER GAS AND ELECTRIC LIGHT CO.
COMMERCIAL DEPARTMENT
GAS AND ELECTRIC BUILDING
15TH AND CHAMPA STREETS
DENVER, COLO.

CLARE N. STANNARD
COMMERCIAL MANAGER
PHONE MAIN 4000

We earnestly try at all times to make our gas, electric and power service so good that none of our patrons will have cause for complaint. Suggestions for improvement are always welcome, because if we are not rendering the most efficient service we want to know about it.

I intend to make a detailed inspection of the service in your district within a short time and I should be pleased to call and look over your present equipment. If you are thinking of putting in some new equipment, I should like to consult you about the matter. I can probably make some suggestions that would be of benefit to you.

It is my duty to carefully attend to all your requirements and to take a personal interest in seeing that your service is efficient.

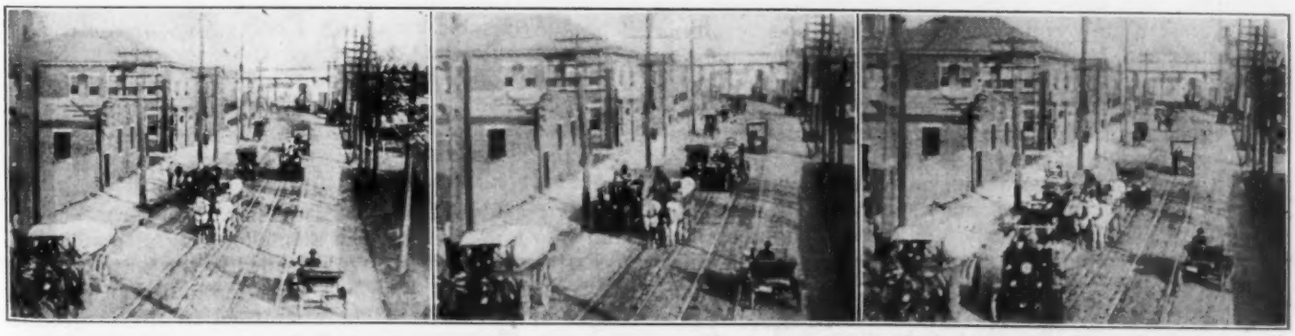
If you will kindly mail the enclosed postal or phone Main 4000, Branch 39, your wants will be attended to promptly and satisfactorily.

Very truly yours,

Representative.

COPY OF LETTER SENT OUT IN ADVANCE OF SUPERVISORS

Some time ago the Denver company inaugurated a "Good Service Department," assigning seven of its best representatives to the work in hand, giving them titles of "supervisors of good service" and paying them good



SECTION OF MOTION-PICTURE FILM, SHOWING ELECTRIC FIRE TRUCKS THREADING AROUND TRAFFIC AT HIGH SPEED

salaries plus commissions dependent upon the results secured by the men in their good-service endeavors.

SEVEN "SUPERVISORS OF GOOD SERVICE"

The city was divided into seven territories. Each man was given 350 names, it being his duty to spend a three months' period on the names selected. He was to call on each consumer, make a careful examination of the premises, ascertain whether or not the company was giving full, complete and satisfactory service. If, in any way, the service was unsatisfactory, he was to report it to the office and make sure conditions were immediately remedied.

As the men employed in this work were excellent salesmen, and were able to come into close contact with the consumer, they were often able to suggest improved service and additional current-consuming devices, which, in many instances, were easily sold, connected up, placed on the lines and became productive of additional revenue for the company.

The supervisors made a specialty of increasing the candle-power by selling high efficiency lamps and a system of indirect lighting fixtures. They made a specialty of making quite sure that all sockets were filled with lamps and burnt-out lamps replaced with perfect ones. They also made sure that all appliances not in use (ofttimes on account of some defect) were placed in use again through the medium of simple repairs.

BONUSES GRANTED ON RESULTS ACHIEVED

At the end of the three months' period, the revenue accounts of the consumers were compared with the accounts for the same three months of the previous year, and the supervisors were given a bonus upon all accounts which showed an increase in revenue secured by the company.

The supervisors have canvassed the entire city on three distinct and separate occasions, and in each instance the successive trip has proven more profitable than the first. In addition to this revenue feature relations with the customers have been rendered more cordial as the public has learned that the company is primarily interested in giving the best possible service.

The advertising in this connection consisted of personal letters sent out in advance by the supervisors and representatives, which outlined the purpose of the representative's call and requested that the customer be prepared to tell how the company could improve its service in his particular case. Inclosed with each letter was a return post card on which the customer was invited to state a convenient time for the representative's call.

ADJUSTMENT OF COMPLAINTS

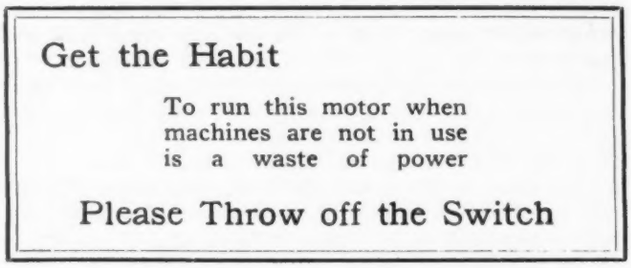
Many complaints were adjusted on the premises by the supervisor, thus saving the expense of sending out trouble men from the office.

The supervisors spent much time in going over ledger accounts, and where a reduction in consumption was noted immediately called on the consumer, ascertaining the cause and frequently bringing the account back to normal or even in excess of normal. In fact, in some instances, it was found that consumption existed without registration, which condition was immediately remedied by a change of meters.

The good service work was not confined alone to the supervisors, but their influence spread to the other departments, such as floor salesmen, special engineers and other outside employees. The men also made it a point to keep in close touch with prominent citizens, city officials and others vitally interested in the city's welfare, making quite sure that they were given full, complete and satisfactory service.

Helping Motor-Service Customer Avoid Waste of Power

It is sometimes hard to convince a motor-service prospect or consumer that the electric company really considers it the best and most profitable policy to help him reduce his light and power bills to the lowest minimum consistent with efficient production.



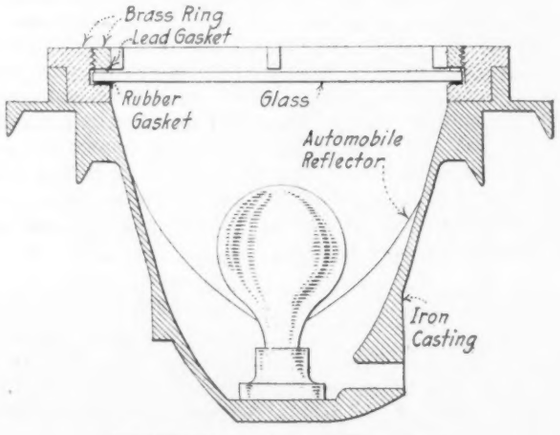
SIGN PASTED ON EACH MOTOR STARTING BOX

Not long ago the Westchester Lighting Company at Mount Vernon, N. Y., made up a number of blueprint signs, like the one in the illustration, and pasted one on each motor starting box in a large factory on its lines. In addition to the saving effected in consumption, this evidence of good faith immediately converted the customer into an active "booster" for the electric company.

Lighting a Swimming Pool with Submerged Lamps

The problem of designing and installing submerged lighting in a Seattle, Wash., swimming pool on short notice, was solved by Gray & Barash, electrical engineers of that city, with the aid of the lighting unit shown in the sketch. The largest automobile reflector obtainable was chosen, and a cast-iron housing was designed to carry the reflector with suitable arrangements for socket and conduit attachments.

In order to insure rigid fastening to the concrete floor, and to prevent the seepage of water through the floor along the plane of contact, the iron casing was provided with lugs as shown in the illustration. A brass



SUBMERGED FLOOD-LIGHTING UNIT

socket ring was fitted into the top of the iron casing, and was tapped to receive a smaller ring also of brass.

Fifteen such units were installed in the bottom of the pool, spaced 10 ft. apart from center to center. Mazda lamps of 150-watt rating were used in the projectors and the effect of the installation as a whole is said to add much to the attractiveness of the pool.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

HYDROELECTRIC POWER IN FRANCE

A First-Hand Sketch by Dr. C. O. Mailloux of the Development of Hydroelectric Power and of Electrochemistry and Electrometallurgy in France

The American Manufacturers Export Association, of which E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, is the president, appointed last year an American Industrial Commission to visit France for a first-hand study of present industrial conditions and future possibilities. Dr. C. O. Mailloux, a prominent consulting engineer of New York City and a past-president of the American Institute of Electrical Engineers, was the electrical member of the commission, and during his stay of several months abroad prepared extensive notes on hydroelectric developments in France, with special reference to the electrochemical and electrometallurgical industries. Only a brief abstract of part of these notes was published in the condensed official report of the commission. In view of the authoritative character of Dr. Mailloux's notes, however, it is gratifying that they are now being published in full in *Metallurgical & Chemical Engineering*, the first part dealing with hydroelectric power in France being published in the issue of the ELECTRICAL WORLD of March 1.

Before the war the annual coal consumption in France was, in round numbers, 60,000,000 tons, of which amount about 40,000,000 tons were obtained from French coal mines, leaving a shortage of about 20,000,000 tons to be made up by importation from other countries. About 75 per cent of the total coal consumed, or about 45,000,000 tons, are used for producing steam for generating mechanical power, aggregating about 12,000,000 hp. This corresponds to about 3,750,000 tons of coal per year for each 1,000,000 hp. of steam-power capacity, so that the full development and utilization of 6,000,000 hp. of water power would, theoretically, more than make up for the entire coal shortage in the whole country. This indicates the immense national importance of water-power developments for France.

Dr. Mailloux gives a very interesting historical sketch of the evolution of hydroelectric developments and of electric transmission systems in France, paying a sympathetic tribute to the life work of Aristide Berges. The term "houille blanche," meaning literally "white coal," for designating the power obtainable from the melting ice and snows of glaciers, is said to have originated with Cavour, the Italian statesman, but it was introduced and made popular in France by M. Berges, the inventor of the high-head hydraulic turbine. He originally employed this term to designate all streams which are fed and regulated by glaciers, because the solidified water in the form of ice and snow in this glacier represents stored energy available for power similar to the stored energy contained in ordinary ("black") coal. The energy available in streams not fed by glaciers was termed "green" coal ("houille verte"), because the energy comes from water stored in green vegetation. The expression "white coal" has, however, gradually enlarged its meaning, and it now means the energy of any waterfall that is available for developing water power; therefore it now practically includes "green" as well as "white" coal.

The first "white-coal" or water-power congress was held at Grenoble in 1902, at the time about 200,000 hp. of hydroelectric power had already been developed. In 1903 the government took action by creating a commission for large water powers, which was entrusted with the work of estimating the hydraulic resources of France. A second water-power congress, organized by an association of water-power owners, was to have been helds at Lyons in September, 1914. It was, of course, postponed. It will likely be held after the war is over.

As in the case of all large industries in France, the water-power industry has its interests looked after by a "get-together" organization, having a very comprehensive name, which includes all concerns interested in water power, electrometallurgy, electrochemistry and "all the industries related thereto." It consists of three groups, the first being devoted to power transmission and distribution (fifty-four companies), the second to electrometallurgy and electrochemistry (twenty-four companies), and the third to "sundry and miscellaneous concerns" (thirty companies).

The aggregate power capacity of all the water powers owned or exploited by the various power companies belonging to that association is 660,000 hp. Of this total, 412,000 hp. represents power transmitted and distributed for general lighting and power purposes in cities, towns and villages; the rest (248,000 hp.) is power consumed by electrometallurgical and electrochemical industries. The distribution systems owned by the power companies belonging to the association constitute a network of 16,200 km. (10,066 miles), of which 13,400 km. (8325 miles) are overhead lines, and the rest (2800 km. or 1740 miles) are underground lines. These distribution systems serve to supply electric current for light and power to communities aggregating between 4,500,000 and 5,000,000 inhabitants. The capital investment represented by all these plants exceeds 600,000,000 francs ($120,000,000).

But as there are many water powers in the Alps and elsewhere operated by companies and individuals not members of the Water Power Association, the above statistics are incomplete. The complete statistics for Jan. 1, 1916, for the region of the Alps are as follows:

	H.P.	Per Cent of Total
Power used for light and power	291,000	39.4
Power used for electrometallurgical works	255,000	34.6
Power used for electrochemical works	147,000	19.9
Power used for electric traction	16,000	2.2
Power used for paper mills, saw mills, etc	23,000	3.1
Power used for various industries (lime and cement works, spinning, etc.)	6,000	0.8
Total	738,000	100.0

The 1916 map of the government commission gives the following additional information for the same region: Power plants under construction or for which contracts have been made, 100,000 hp.; water powers whose development is contemplated or proposed, 700,000 hp. The two most important new water-power projects are the Durance and the Upper Rhone projects, con-

cerning which interesting notes are given by Dr. Mailloux. After some remarks on developments in the Pyrenees, figures are given showing the growth of the electric service in France. The total electrical energy consumption in kilowatt-hours, supplied by the electric plants of the Lyons Gas Company, has increased from 399,100 kw.-hr. in 1897 to 35,400,000 in 1915, or at the end of eighteen years it was more than ninety times greater. Of that growth 88 per cent occurred in the last five years of that period.

Interesting figures are given on the rates charged for electrical energy in France, with special reference to Lyons and St. Etienne. At Lyons the kilowatt-hour is charged at 60 centimes (12 cents) for domestic lighting, at 55 centimes (11 cents) for stores, offices and factories, at 50 centimes (10 cents) for hotels, cafés, restaurants, theaters, churches, schools, etc., and at 40 centimes (8 cents) for small power consumers. Discounts from 2 to 20 per cent are allowed, according to the amount of the yearly bill. At St. Etienne 55 centimes (11 cents) are charged per kilowatt-hour for lighting for the first 1000 hours, but the rate is 50 centimes (10 cents) for the next 400 hours, etc., and 30 centimes (6 cents) for all above 3300 hours. There are flat-rate and meter tariffs in use for power purposes, and it is interesting to note that the minimum price for metered power current comes down to as low as 5 centimes (1 cent) per kilowatt-hour in St. Etienne as well as at Lyons. This is a very low figure, which prevails only where hydroelectric power is available. At Bordeaux, where black coal is the only source of power, the power used for operating the coal and ore-handling and conveying system at the Bordeaux docks costs 12 centimes (2.4 cents) per kilowatt-hour. This is regarded as a low figure for electric power current derived from a steam station, even allowing for the advantage which a seaport city has of being able to get its coal supply at lower cost than an inland city. Nevertheless, this very reasonable cost is still 2.4 times greater than the lowest cost of electric power at Lyons and at St. Etienne, which is a significant fact.

Generators, Motors and Transformers

Transient Conditions in Non-Synchronous Induction Motors.—R. E. HELLMUND.—A profusely illustrated paper read at the New York meeting of the American Institute of Electrical Engineers discussing a number of transient conditions in a non-synchronous machine immediately after certain changes in the circuit connections are made. The principal subjects considered are undesirable peak currents which may be caused by the damping effect of the short-circuited rotor windings, and the over-voltages which are obtained with certain control arrangements. These matters have to be taken into consideration in the control layout so as to provide for a harmonious combination of motor and control design.—*Proceedings*, Amer. Inst. Elec. Engrs., February, 1917.

Lamps and Lighting

Economics of Office Building Lighting.—SAMUEL G. HIBBEN.—A paper read before the Illuminating Engineering Society. Study is made of the lighting of typical offices by different methods, including various sizes of units and types of equipment. Consideration is given to the wiring, fixtures, upkeep and other details of service. The rental value of offices as affected by natural and artificial illumination is dealt with. A number of curves and charts are included, showing the effects of different types of shades, of different hanging heights, etc., on the intensity of illumination. The cost of several sample installations are compared from the standpoint of economy in installation and operating costs.—*Transactions Illum. Eng'ing Soc.*, Dec. 30, 1916.

Wires, Wiring and Conduits

Fuses on Short-Circuit.—In the testing of fuses as an ultimate safeguard it is desirable to test them on a dead short-circuit, and it is emphasized that the change of generating plant from reciprocating engines to steam turbines has increased very materially the current which fuses may be called upon to carry before they blow, and that consequently the rate at which energy is dissipated at the moment of rupture may be much higher than was usual some years ago. This has been the experience of S. W. Baynes of the municipal electric supply station of the St. Pancras Borough in London, where many more failures of fuses have been noticed since the introduction of large turbo-alternators.

Tests have been made of fuses under working conditions and some photographs of fuses on short-circuit are shown. Baynes concludes that fuses of the

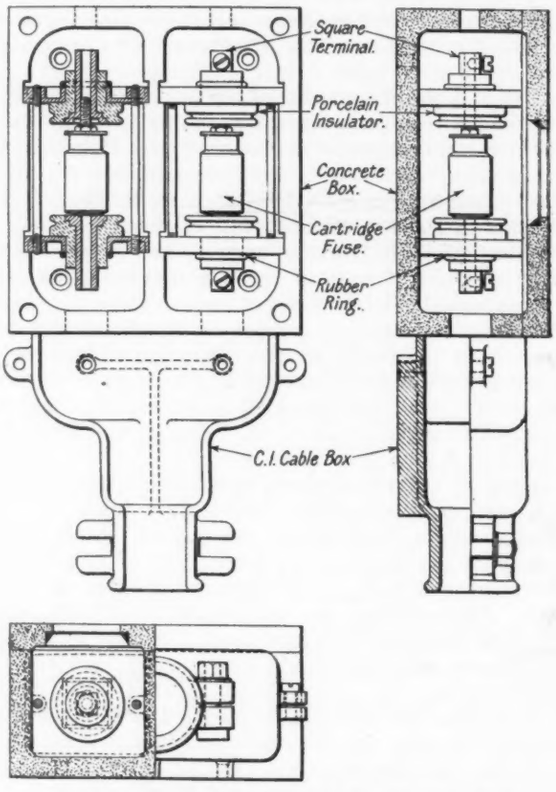


FIG. 1—DETAILS OF LATEST TYPE OF CONCRETE FUSE BOX AND FITTINGS

cartridge type should be used, and that they should be so made that they cannot be easily bridged by ordinary fuse wire instead of being properly replaced when blown. Owing to the destructive effect which takes place if an arc strikes earthed metal, he has designed fuse boxes made entirely of special concrete. Details of the latest type of boxes are given in Fig. 1.

These new fuse boxes made of special concrete are fitted with brass screw sockets so that the lids can be easily fastened on, and they are used in conjunction with cast-iron cable sealing boxes, both the cast-iron box and the concrete box being fixed to the wall as indicated. The internal fittings are of simple design for carrying fuse cartridges; these are fixed very easily by means of the screw shown. There is no possibility of damage by an arc striking earthed metal. The boxes are so made that they can be fixed side by side and coupled together so as to be adaptable to the circuit to be supplied.—London *Electrician*, Feb. 9, 1917.

Electrophysics and Magnetism

Unipolar Induction: An Experiment and Its Significance as Evidence for the Existence of the Ether.—E. H. KENNARD.—The question as to the correctness of the "moving-line" theory can be subjected to experimental trial. A suitable but difficult arrangement consists of a cylindrical condenser inside a coaxial solenoid (Fig. 2), both capable of rotation about their longitudinal axis; the condenser is connected to an electrometer as shown. Let the condenser be short-circuited and set in rotation with the solenoid energized. Then, according to either Lorentz's or the moving-line theory (but not according to Hertz's), the two cylinders of the condenser should come to different potentials, and the inner one at least should be charged. According to Lorentz's theory, rotation of the solenoid should have no effect upon this charge. According to the moving-line theory, rotation of the solenoid alone should charge the condenser in the same manner, while the condenser should remain uncharged when condenser and solenoid rotate together with no relative motion between them. Barnett constructed an apparatus of this sort and showed that rotation of the solenoid alone developed no charge upon the condenser. The present author has made a careful investigation with a new apparatus of this kind. His results are somewhat rough, but they seem sufficient to warrant the conclusion with fair certainty that the condenser becomes charged by its own rotation in the manner required by Lorentz's theory, independently of the rotation of the solenoid. In the author's opinion, the moving-line theory is definitely disposed of by the results obtained by Barnett, Fehrle and the author. Electromagnetic induction depends in part upon absolute rotation in the mechanical sense. Analysis in terms of electrons seems to make necessary the existence of a stationary ether in order to explain the observed effect; so that the phenomenon seems to present difficulties for those relativitists who reject the ether. "The practical bearing of these experiments is small, yet they do necessitate a correction of certain statements that are common in the text-books. For instance, it is not correct to say

FIG. 2—ARRANGEMENT OF CYLINDRICAL CONDENSER INSIDE COAXIAL SOLENOID TO DETERMINE CORRECTNESS OF "MOVING-LINE" THEORY

that the effect of rotating the armature of a dynamo is the same as that of rotating the field magnets in the opposite direction. The total emf. is the same, but in the first case it is developed almost entirely in the longitudinal parts of the winding, while in the second case a large fraction of it is developed in the radial parts, and the distribution of electrification on the armature will be different."—*Philos. Mag.*, February, 1917.

Units, Measurements and Instruments

Resistance Standardizing Bridge.—C. V. DRYSDALE.—A detailed and fully-illustrated description of a universal resistance standardizing bridge of the combined Kelvin-Carey-Foster type which enables resistances of all values from the highest to the lowest to be compared with the greatest degree of accuracy and convenience, and enables all the values to be determined in terms of a single standard. Some recent improvements of design are described and the complete theory of the bridge is given with numerical examples.—London *Electrician*, Dec. 29, 1916, and Jan. 5, 1917.

Localization of Faults.—H. HEINZELMANN.—If two auxiliary cables, *AB* and *CD*, are available, it is possible to locate a fault in a cable, *EF*, by two resistance measurements made at the end, *F*, of the faulty cable by the method described, in which the resistances of the two auxiliary cables do not enter. The cables are connected as shown in Fig. 3, *G* being a galvanometer and

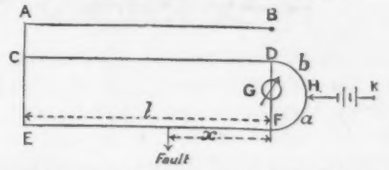


FIG. 3—METHOD OF CONNECTING AUXILIARY CABLES AND FAULTY CABLE TO LOCATE FAULT

DHF a bridge wire. The balance point *H* is found with the battery terminal *K* connected first to *B* and second to earth. If the bridge wire is divided into the ratios $a : b$ and $a' : b'$ in these two measurements, and if the faulty cable has a length l and the fault is at distance x from *F*, it follows that $x = la'/a$. It is assumed that $a + b = a' + b'$.—*Elek. Zeit.*, Sept. 21, 1916; abstracted in *Science Abstracts*, Section B, Jan. 31, 1917.

Lubrication of Resistance-Box Plugs.—J. J. MANLEY.—It is important that the resistance of plug resistors should be practically invariable. When a plug is seated by the usual screw-like movement, the engaging surfaces tend to plough each other, and as a result burrs and grooves appear upon both. These burrs and grooves, which change in size, number and form as the coils are used, appear to be entirely responsible for the variations observable in plug resistance. The author describes quantitative experiments which show that lubricating plugs are an efficient remedy. The best results were obtained by the use of vaseline.—*Philos. Mag.*, February, 1917.

Miscellaneous

The Adoption of the Metric System in the United States.—A series of articles on this subject. A. E. Kennelly discusses the metric system from the standpoint of the electrical engineer; William C. Wells from the Pan-American standpoint; Fred R. Drake from the standpoint of the wholesale grocers and canning industry; A. W. Miller from the standpoint of the wholesale druggist; H. V. Arny writes on the metric system in every-day life and G. F. Kunz on the international language of weights and measures. In Kennelly's article it is pointed out that the real question to be considered at this time is not whether the Anglo-American system shall or shall not be indefinitely retained. That question was settled long ago, when all the other countries of the world came, one by one, to adopt the metric system. The real question is how, and how soon, the English-speaking peoples should change to the international metric system. Deferring the change does not make it any easier. The individuals most inconvenienced by the change would probably be the intellectually aged. The American Institute of Electrical Engineers took a canvass in 1902 of their membership on the question of the adoption of the metric system by Congress. A large majority were in favor of the change. Electrical units, which are international and in world-wide use, are already metric. No sudden transition should be invoked by Congressional action. Ample time for preparation should be allowed in any legislation directed toward the change. In this way lists, catalogs and sizes could all be tabulated in advance in both systems, side by side, so that gradually the old numerical values could be dropped. The easiest and least expensive way of introducing the system

would probably be to have certain United States government departments adopt the system exclusively after a certain date. Only those persons or firms dealing directly with those departments would then be compelled to change their listings and prices. Gradually, the process would be likely to extend into general literature, business and manufacture, without the exercise of compulsion.—*Scientific Monthly*, March, 1917.

Book Review

THE MECHANICAL ENGINEERS' HANDBOOK. By Lionel S. Marks, Editor-in-chief. New York: McGraw-Hill Book Company, Inc., 1179 pages. Illustrated. Price, $5.

This volume, compiled under the able direction of Prof. Lionel S. Marks as editor-in-chief, assisted by fifty specialists, has been based on the mechanical engineering section of the famous "Hutte," the German reference work generally accepted by German engineers. The material of the "Hutte" has not been closely followed except in the more theoretical sections, the data and information on engineering practice being carefully selected from American practice, the German text being followed mainly in form and schemes of handling the various topics.

The book divided itself into two main sections, the first 860 pages being devoted to theoretical topics, and the last 960 pages to current practice. The more theoretical portion is subdivided into seven sections, dealing with the following subjects: Mathematical tables and weights and measures; mathematics; mechanics of solids and liquids (including friction); heat; strength of materials; materials of engineering, and machine elements. The portion treating of practice is divided into eight sections dealing with power generation; hoisting and conveying; transportation; building construction and equipment; machine shop practice; pumps and compressors; engineering measurements, mechanical refrigeration, etc. The section on friction was prepared by Professor Hess of Cornell University, and the section on hydraulics by Professor Schoder, also of Cornell University. The section on heat has been written by Professor Goodenough of the University of Illinois. Professor Hatt of Purdue University contributed a section on strength of materials, including theory of reinforced concrete design. The list of contributors for the section on "materials of engineering" includes Dr. Fischer of the Bureau of Standards, Dr. Moldenke, secretary of the American Foundrymen's Association (cast iron); Mr. Clamer of the Ajax Metal Company (nonferrous metals), Sanford E. Thompson (cement, mortar and concrete), Mr. Hood of the U. S. Bureau of Mines (fuel), and six others. The subject of machine elements has been contributed by Professor Rauttenstrauch of Columbia University, with the important addition by Dr. Loewenstein of the General Electric Company, of articles on disk wheel stresses and critical speeds of shafts, and of Professor Ham of Cornell University on pipe and pipe fittings.

Power generation is treated under the headings of steam boilers, the steam engine, steam turbines, condensation, internal combustion engines, waterwheels, hydraulic turbines, and cost of power. The authors include Professor Ennis of the Polytechnic Institute of Brooklyn (steam engines), Dr. Loewenstein of the General Electric Company (steam turbines), Professor Marks of Harvard University (internal combustion engines), Mr. White of the Allis-Chalmers Company (hydraulic turbines), and Mr. Orrok of the New York Edison Company (condensation). This section occupies more than 240 pages. C. K. Baldwin of the Robbins Conveying Belt Company prepared the section on hoisting and conveying. The subject of machine shop practice is adequately covered by Mr. Alford, former editor of the *American Machinist*. Reciprocating pumps were handled by Mr. Nickel of the H. R. Worthington Company, air compressors by Professor Thorkelson of the University of Wisconsin, centrifugal pumps and centrifugal compressors by Dr. Lowenstein of the General Electric Company, and centrifugal fans by Mr. Williams of the B. F. Sturtevant Company. Much hitherto unpublished information is contained in these pages, particularly the treatment of the centrifugal machines.

The section on electrical engineering has been contributed by Professor Beebe of the University of Wisconsin. A miscellaneous section includes the subjects of measuring instruments by Professor Moyer of Pennsylvania State College, surveying by Professor Raymond of the State University of Iowa, mechanical refrigeration by Mr. Fairbanks of the Quincy Market Cold Storage & Warehouse Company, patents for inventions by Mr. Odin Roberts, the A. S. M. E. testing codes, instructions for first aid treatment, and other matter.

The use of the book is facilitated by thumb tabs, which mark the locations of the different sections, and by the section subject index on the inside of each cover referring to the number of the corresponding thumb tab.

Books Received

ALTERNATING CURRENTS. By H. R. KEMPE. New York: D. Appleton & Company. Twenty-five illustrations; 83 pages. Price, $1.50.

GOVERNMENT TELEPHONES. The Experience of Manitoba, Canada. By James Mavor, Ph. D. New York: Moffat, Yard & Company. 176 pages. Price, $1.

SELLING YOUR SERVICES. New York: The Sales Service Company. 176 pages. Price, $1.

THE MECHANICAL WORLD POCKET DIARY AND YEAR BOOK. For 1917. Baltimore, Md.: The Norman, Remington Company. 382 pages. Illustrated. Price, 40 cents.

UNDERGROUND TRANSMISSION AND DISTRIBUTION FOR ELECTRIC LIGHT AND POWER. By E. B. Meyer. New York: McGraw-Hill Book Company, Inc. 312 pages. 156 illustrations. Price, $3.

LIGHT AND SHADE AND THEIR APPLICATIONS. By M. Luckiesh. New York: D. Van Nostrand Company. 135 illustrations. Ten tables. 266 pages. Price, $2.50.

EXPERIMENTAL ELECTRICITY COURSE. In Twenty Lessons. By S. Gernsback and H. W. Secor. New York: The Experimenter Publishing Company. 160 pages. Illustrated. Price, $1.

WIRELESS COURSE IN TWENTY LESSONS. By H. W. Secor, S. Gernsback and A. Lescarboura. New York: The Electro Importing Company. 160 pages. Illustrated. Price, $1.

THE BOOK OF ELECTRICITY. Written to conform to the tests of the Boy Scouts. By A. Frederick Collins. New York: D. Appleton & Company. 186 pages. 145 illustrations. Price, $1.

ENGLISH AND ENGINEERING. Edited by Frank Aydelotte. New York: McGraw-Hill Book Company, Inc. 390 pages. Price, $1.50.

MANUFACTURING COSTS AND ACCOUNTS. By A. Hamilton Church. New York: McGraw-Hill Book Company, Inc. 452 pages. 138 illustrations. Price, $5.

Phase-Rotation Meter

To the Editor of ELECTRICAL WORLD:

SIR: The writer was very much interested in the description on page 226 of your Feb. 3 issue, of a phase rotation indicator devised by E. P. Peck of Atlanta, Ga. I would like to call your attention to the fact that such a device was used by me about thirteen years ago and that a patent (No. 787,345) issued to me contains, among the eleven claims allowed, the following one, which fully covers devices of the kinds used by Mr. Peck:

"A device of the class specified, comprising means operable by the energy of the polyphase system and means whereby such operation can be interpreted to indicate the direction of phase rotation with reference to the leads of such system and substantially as described."

Commercial instruments based on this patent have been manufactured for many years and are in use in a great many central station systems.

R. F. SCHUCHARDT.

Chicago, Ill.

Naval High-Powered Radio Station

To the Editor of ELECTRICAL WORLD:

SIR: With reference to the editorial in the ELECTRICAL WORLD of Feb. 10, 1917, entitled "Naval High-Powered Radio Stations," I beg to submit the following comments and explanations, as I feel that without them the editorial is not complete.

The San Diego station is nominally rated at 200 kw., not 150 kw. as mentioned. However, high input means little as the efficiency of the apparatus governs its output and the latter is the measure of its sending radius. Speaking more technically, the product of antenna amperes times the effective height is the only true measure of the sending radius of a radio station.

On this fair basis of comparison the San Diego station is not "nearly as large as the great Sayville station, which has been used to communicate with Germany," as your editorial states, but is rather the most powerful plant in the world to-day.

The Pearl Harbor and Cavite plants when completed will exceed the San Diego station in antenna current and will then become the most powerful plants in existence.

With reference to your mention of the electrical efficiencies of the large arc converters, I am not permitted to give figures, but can assure you that they compare very favorably with the efficiency of any other method of obtaining continuous undamped oscillations in use at the present time.

The performance of these arc converters on test has shown that units of 1000 kw. capacity can be built by the Federal company at any time and that their efficiency in converting direct-current power into high-frequency power will be, to many, surprisingly high.

L. F. FULLER,
Chief Electrical Engineer
Federal Telegraph Co.

San Diego, Cal.

Readers' Views and Comments

Significance of Digits

To the Editor of ELECTRICAL WORLD:

SIR: The writer has received copies of the "Code of Lighting for Factories, Mills and Other Work Places" of the State of New Jersey, department of labor, and the "Lighting Code," State of Pennsylvania, industrial board, department of labor and industry.

I wish to call attention to the disregard of the significance of digits. In each publication, Rule 2, covering "Intensity Required," states: "The desirable illumination intensity to be provided and the minimum intensity, which shall be maintained, are shown in the following table:

TABLE I—NEW JERSEY CODE OF LIGHTING—INTENSITY REQUIRED

	AT THE WORK	
	Minimum Foot-Candles	Ordinary Acceptable Practice
A. Roadways and yard thoroughfares	0.05	0.05– 0.25
B. Stairways, passageways, aisles, storage spaces	0.25	0.25– 0.50
C. Rough manufacturing operations such as foundry work, rough machining, rough assembling, rough bench work	1.25	1.25– 2.50
D. Fine manufacturing operations such as fine lathe work, pattern and tool making, light colored textiles, tobacco manufacture	3.50	3.50– 6.00
E. Special cases of fine work, such as watch making, engraving, drafting, dark colored textiles	5.00	10.00– 15.00

TABLE II—PENNSYLVANIA CODE OF LIGHTING—INTENSITY REQUIRED

	AT THE WORK	
	Minimum Foot-Candles	Ordinary Acceptable Practice Foot-Candles
1. Roadways and yard thoroughfares	.05	.05–0.25
2. Stairways, passageways, aisles, storage spaces	0.25	0.25–0.5
3. Rough manufacturing operations such as foundry work, rough machining, rough assembling, rough bench work	1.25	1.25–2.5
4. Fine manufacturing operations such as fine lathe work, pattern and tool making, light colored textiles, tobacco manufacture	3.50	3.50–6.0
5. Special cases of fine work such as watch making, engraving, drafting, dark colored textile	5.00	10.00–15.00

The values of illumination given for the first class of working planes contain two significant figures. The values given for the second class of working planes contain in some cases two and in another case one significant figure. The values given for the third and fourth class of working planes contain in some cases three and in another case two significant figures. The values given in the fifth class of working planes contain in some cases three and in other cases four significant figures. In order that the result of any measurement may be of value, it is necessary to include some numerical measure of its reliability.

When the results of a scientific investigation are of sufficient importance to become a law enforced by fine or imprisonment, the figures defining the law should be correctly written to conform with accepted practice.

DAVIS H. TUCK.

Pittsburgh, Pa.

The Small Pumping Load

To the Editor of ELECTRICAL WORLD:

SIR: Pumping is usually considered a very desirable form of load by central-station companies and one they are anxious to develop to the full. With the increase of rural transmission lines and the ever-increasing territory served by them the pumping load is one the salesman is frequently called upon to solicit. In many cases the water to be pumped may be for domestic or agricultural purposes or for fire protection. The ability to place an installation upon central-station service, however, depends upon whether it can be done with a low initial cost.

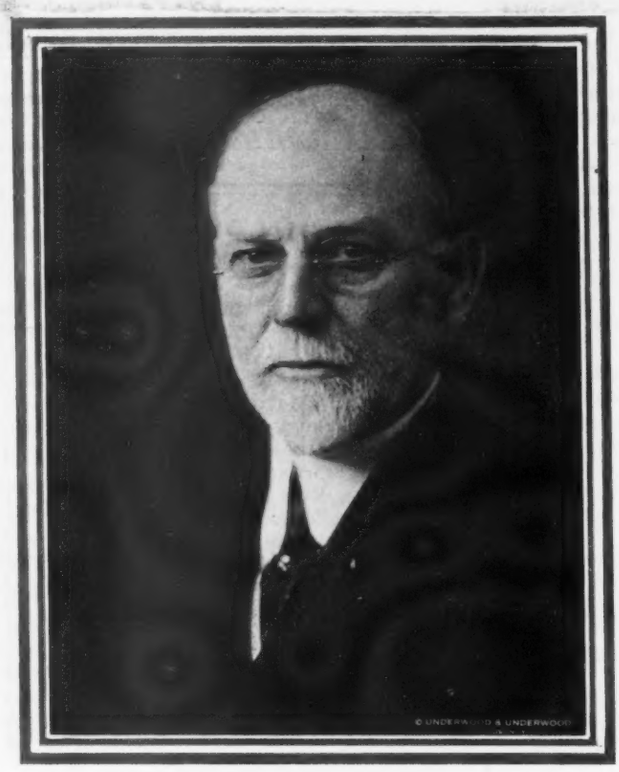
In designing small rural pumping stations which will be served from rural transmission lines, and often from inexpensive outdoor-type sub-stations, one of the chief factors to consider is whether to install a relatively small motor and pump which can operate continuously over long periods or whether to put in a larger motor and pump for occasional operation over shorter periods of time. This is necessary since economy of operation as well as first cost depends on this consideration. Speaking generally, it will be found to the best advantage of both customer and central-station to adopt the smaller unit. The smaller unit has a lower first cost, while the expense for renewals and depreciation likewise will be lower. Furthermore the load factor will be higher because the unit is in service longer each day. Since the average water level will be higher when the smaller pump is used, the average head will be lower, thus compensating for the lower efficiency of the smaller pump.

For the customer the smaller pumping set possesses the advantages of having a lower initial cost and a lower operating expense, factors that often enable him to make such an installation where otherwise he could not afford to do so. For the central-station company the smaller pumping set offers the advantages of higher load factor, lower peak demands and relatively constant demands for power from its lines. In connecting loads of this kind the storage tank and the pump should be chosen to allow the customer the benefit of off-peak service. This can be done by using a higher-rated pump or larger-capacity tank, the latter being the more economical.

GILBERT RUTHERFORD.

Evanston, Ill.

Steady Growth from Unvarying Service to the Engineering Industries



JAMES H. McGRAW

Founder and head of McGraw Publishing Company, who becomes president of the new McGraw-Hill Publishing Company, Inc., formed to extend and strengthen the influence of great engineering and business journals, leaders in their fields, creative workers for industrial welfare and prosperity.

Position of the Electrical World in the Large Technical Newspaper Consolidation

IN last week's issue, a brief announcement was made of the consolidation of the McGraw and Hill Publishing companies. By this means, the McGraw-Hill Publishing Company, Inc., acquires the ELECTRICAL WORLD, *Electric Railway Journal, Electrical Merchandising, Engineering Record, Metallurgical & Chemical Engineering, The Contractor, American Machinist, Power, Engineering News, Engineering & Mining Journal* and *Coal Age*, each the leader in its field. The new organization, therefore, under the guidance of James H. McGraw, its president, becomes the dominating influence in American technical journalism.

All the traditions and aspirations of both institutions fall as a heritage to the new publishing company, and inasmuch as the personnel of the two organizations will remain intact, the service to the reader will be greatly improved through the advice and counsel of the greater number of editors. The *Engineering News* and *Engineering Record* will be consolidated as *Engineering News-Record*, making the largest and most influential civil engineering and contracting journal in the world.

PRINCIPLES OF SERVICE

It is well that readers should know the principles which have animated James H. McGraw throughout his long and successful career as a publisher and which have been instilled into the minds of everyone connected with the organization. These principles, which may be referred to as the decalogue of journalistic practice, have also pervaded the Hill organization and are as follows:

1. To consider, first, the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To eliminate, in so far as possible, personal opinion from news columns, but to be a leader of thought in editorials, and to make criticisms constructive.
4. To refuse to publish "puffs," free reading notices or paid "write-ups"; to keep reading columns independent of advertising considerations, and to measure all news by this standard: "Is it real news?"
5. To decline any advertisement which has a tendency to mislead or which does not conform to business integrity.
6. To solicit subscriptions and advertising solely upon the merits of the publication.
7. To supply advertisers with full information regarding character and extent of circulation, including detailed circulation statements subject to authentic verification.
8. To co-operate with all organizations and individuals engaged in creative advertising work.
9. To avoid unfair competition.
10. To determine what is the highest and largest function of the field which is served, and then to strive in every legitimate way to promote that function.

FIELD OF THE ELECTRICAL WORLD

Although Mr. McGraw has been the active head and publisher of the *Electric Railway Journal* since 1888, his connection with the other branches of the electrical industry dates from 1896, when he purchased *Electrical Industries* which was renamed the *American Electrician* and issued as a monthly publication devoted to electrical and mechanical engineering. Three years later he acquired the *Electrical World* and the *Electrical Engineer*, the two leading electrical weeklies, and consolidated them into the *Electrical World & Engineer*. In 1906 the *American Electrician* and the *Electrical World & Engineer* were combined into the present ELECTRICAL WORLD. Last year *Electrical Merchandize & Selling Electricity* was purchased and the name changed to *Electrical Merchandising*. This journal, which is published monthly, is designed to supplement the ELECTRICAL WORLD, which still remains the great electrical weekly dealing with the serious side of the electrical industry. The ELECTRICAL WORLD is edited for the technically trained and professional electrical engineers, the managers and operators of electrical public utilities and large industrial establishments, electrical manufacturers, jobbers and contractors. *Electrical Merchandising*, on the other hand, finds its field with the dealer, contractor and other commercial men engaged in the sale and exploitation of apparatus and appliances. Last month the *Lighting Journal* was merged with the ELECTRICAL WORLD and *Electrical Merchandising*, that branch of the paper dealing with the science and art of illumination being added to the ELECTRICAL WORLD.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

QUESTION BOX CONVENTION OF N. E. L. A. NEW ENGLAND SECTION

Good Attendance at This Week's Meeting in Boston, with Accountants' Responsibility, Depreciation, Accident Prevention and Other Central Station Topics on the Program

A well-attended question box convention was held this week by the New England Section of the National Electric Light Association at the Engineers Club auditorium, Boston, Mass.

On Wednesday morning an accounting session was held under the chairmanship of H. A. Gidney, general auditor of C. H. Tenney & Company, Boston. An extended discussion took place upon the question of making accounting officers of public utilities responsible for all records and charged with authority to establish the form of these in production, distribution and other departments outside the office. Depreciation accounting also occupied the convention's attention, after which the general subject of accident prevention was opened for discussion under the chairmanship of H. W. Moses, superintendent of the welfare bureau, Edison Electric Illuminating Company of Boston. The afternoon session was devoted to a discussion of the economics of steam heating with respect to the installation of central station service, G. F. Parsons, of C. D. Parker & Company, Boston, presiding.

On Thursday morning advertising and publicity were discussed under the chairmanship of Willard Hall, of the Narragansett Electric Lighting Company, Providence, R. I., followed by a discussion of the problem of increasing gross income from electric lighting and the education of employees in public relations under the chairmanship of C. E. Greenwood of the Boston Edison company. For the closing session a general discussion on central station topics was scheduled.

FEDERAL AUTHORITIES VISITING SITES FOR NITRATE PLANT

Inter-Department Board and Associates, Cabinet Officers and Other Government Officials to See Locations Proposed in Various Cities

The inter-departmental board on the location of nitrate plants left Washington on March 8 to visit several sites mentioned as possible locations for the federal nitrate plant. Among the cities to be visited are Birmingham, Ala.; Columbia, S. C.; Tuscaloosa, Ala.; Augusta, Ga.; Louisville, Ky.; Sheffield, Ala.; Wheeling, W. Va., and Nashville, Tenn.

The inspection party includes Secretary Lane of the Interior Department; Secretary Houston of the Agricultural Department; Secretary Baker of the War Department; General Black and Colonel Keller of the Corps of Engineers, War Department; Colonel Wheeler of the Ordnance Department of the Army; Mr. Merrill, chief engineer of the Forestry Bureau; Mr. Carruthers, chemist in charge of nitrate experimental laboratory; Mr. Parsons, chief chemist of the Bureau of Mines. They will return to Washington about March 16.

LARGE ATTENDANCE PROMISED FOR ASSOCIATED MANUFACTURERS

Edward N. Hurley Asks That Members Be Prepared with Questions if They Seek Particular Information Bearing on His Far-Reaching Activities

In addition to Edward N. Hurley, retiring chairman of the Federal Trade Commission, who is to address the Associated Manufacturers of Electrical Supplies at the annual banquet in New York on March 15, the members will hear the Hon. Job Hedges, attorney, of New York City. As stated in previous issues, the annual meeting and banquet will be held at Delmonico's.

Mr. Hurley has suggested that the members be prepared to ask him any questions they choose on subjects bearing on his recent work. His deep interest in the promotion of sound accounting principles for merchants and manufacturers and his conviction that only the adoption of such principles will place industry on a stable foundation have had a profound effect upon the activities of the Federal Trade Commission. This movement is close to the Associated Manufacturers, and the appearance of Mr. Hurley presents an opportunity for the members to talk over a subject bearing directly upon their future prosperity.

At the annual meeting of last year about 160 representatives were present. Inquiries received this year by the general secretary of the association, Charles E. Dustin, indicate a much larger attendance at the gatherings to be held next week.

INDUSTRY TO VOTE ON 1917 ELECTRICAL WEEK

Society for Electrical Development Sends Out Ballots Asking Whether 1917 Activities Shall Be Held as Formerly or Split Into Two Campaigns

Because there seems to be a difference of opinion concerning the best time for a national electrical week the Society for Electrical Development is sending out this week to the members of the electrical industry of the country a ballot with two questions: (1) Shall there be another electrical week in 1917? or (2) shall the electrical week of 1917 be set over until the spring of 1918 and the effort this fall centered in a "Buy Electrical Christmas Gifts" campaign?

Comments have shown the society that there is a well defined feeling in the industry that the plan followed in the past two years to promote the "shop early" idea for the Christmas trade, and thereby stimulate holiday sales, could be bettered by using Christmas time for promoting the holiday trade alone, and to further the general education of the public in electrical matters by a national electrical week at some other time.

The ballots go out in a booklet entitled "A $3,000,000,000 Industry Pulls Together," which is an official record of America's Electrical Week. The booklet takes up the many activities of the week in detail according to the character of the local celebrations.

Coal Cost and Shortage—Meeting the Problem

What Central Western Companies Are Learning as a Result of the Unprecedented Fuel Conditions, Which Endanger Continuity of Service and Add Heavily to Operating Costs

CENTRAL station companies are looking for a solution of the large problem revealed by the winter's experience in coal cost and shortage. They are turning, first, to efficiency in the purchase, transportation, handling and burning of this prized commodity. If they cannot reduce unit costs to a figure which can be absorbed in operating expenses without undue strain, they will have to consider whether rates should be revised. Experiences of various companies, as told to the ELECTRICAL WORLD in this issue, show how closely the problem is being studied. Facts and probabilities of the future are being appraised so that the meaning of this powerful change in the conditions governing central station operation may be appreciated in its full importance.

WHAT SHALL CENTRAL STATION COMPANIES DO?

John F. Gilchrist: Advise railroads to figure on rapid growth in coal tonnage.

W. W. Freeman: It may be imperative to readjust power rates.

D. L. Gaskill: Conferences looking toward united action to raise power rates are being held.

J. F. GILCHRIST ON CHICAGO SITUATION

In an interview with the representative of the ELECTRICAL WORLD, John F. Gilchrist, vice-president in charge of purchasing, stores, transportation and statistical departments of the Commonwealth Edison Company, Chicago, said that it is high time for central station companies to call forcibly to the attention of railroads the vast growth in the use of coal in their cities. In these great centers of population there are many plants in daily operation burning coal. Even in ordinary times they pretty well strain terminal facilities. When there is a threatened railroad strike, as there was in 1916, or when a car shortage like the one at hand arises, things are worse. The Commonwealth Edison Company is now using 7000 tons of coal a day. Experience indicates that its coal consumption doubles every four years. In 1921 the company will use probably 14,000 tons; in 1925, 28,000 tons; in 1929, 56,000 tons. The use of coal by others in the city will no doubt also grow. So, in arranging for terminal facilities, plans for which must necessarily be laid years in advance, the railroads should figure on this rapid growth in tonnage. They should be warned to do so by the central station men, who can help them see ahead.

Other suggestions made by Mr. Gilchrist were: "Another thing this winter has brought out is that the rulings of the Interstate Commerce Commission, which are fair in the main, do not always work most advantageously toward the desired end. To illustrate, there was a coal company in Illinois owning five mines—four small and poorly equipped, and one large and well equipped with most modern and efficient electrical machinery. By operating the latter mine at its full capacity, this company could have produced and sold coal as cheaply and perhaps more cheaply than any other producing company in the State. But the commission had ruled that each mine should have and should use a certain allotment of cars. The allotment for the big mine was not sufficient to keep it operating at its full capacity and highest efficiency. The company's total allotment of cars for all five mines would have been enough for the big mine, but on account of the commission ruling, the cars had to be used at the mines to which they were assigned. The result was that this coal company with its magnificent equipment to produce coal cheaply, could not do its utmost to help reduce the abnormal prices. Neither could it make money for itself.

"The recent situation has also demonstrated that coal for public utilities should be a preferred commodity. Under the great boilers of their plants it is burned most economically and renders a needed service to the greatest number of people.

UTILITY RATES SHOULD COVER COAL MAN'S PROFIT

"This winter's coal shortage has demonstrated conclusively that it is poor policy for utilities to try to run their businesses and base their rates on coal figured at prices less than the actual mining and transportation costs. Just because mine operators do not know their costs and have sold coal at less than they could afford to produce it, is no reason why a great coal-consuming industry should base its operations on those ridiculously low prices. Some day the mine owners will know their costs, the market will become better organized, or a real railroad tie-up may arise. Then trouble will loom for the public utilities. The central-station executives should recognize this; furthermore, commissions should frown on rate schedules that do not include a coal cost sufficiently high to permit the coal producer to make a profit. Such a schedule could not be other than unstaple.

COAL SUPPLY PREPAREDNESS NOT EXPENSIVE

"The coal used by the Commonwealth Edison Company this winter has cost more than it does ordinarily, but even in spite of this the company seems to have been more fortunate than the great majority of Middle Western utilities. Its good fortune can be attributed to the foresight which led its president, Samuel Insull, many years ago to provide adequately against coal shortage. This has been done by purchasing mines and mining rights, providing strategically located transportation and switching facilities and adequate coal-storage spaces. From its own mines the company gets 50 per cent of its coal at a cost of a little over $2 a ton—not mining coal itself but securing it through an operating company—the Peabody Coal Company. The remainder of its fuel supply is 'free' coal purchased in the local market. Sometimes, on account of market conditions, it is possible to pick up a few per cent of the needed supply of free coal at prices as low as $1 a car plus demurrage. The cost of free coal this year was from $4 to $5 a ton.

"From its own mines the company owns a short steam railroad which intersects the lines of four great north and south railways reaching Chicago. At that city the company has two electric and three steam switching locomotives that can assist in straightening out terminal difficulties. Besides taking these precautions the company always enters the winter with 450,000 tons.

or from sixty to ninety days' supply, in storage at its plants. How adequate this storage must be is indicated by the fact that to-day the company has about 210,000 tons of coal in storage in Chicago.

"In ordinary years the company no doubt paid more for its coal under this system than it might have through some other. A short-sighted critic might have said, therefore, that the coal-supply system was expensive. But the experience of this winter has demonstrated beyond doubt that the existing plan is not expensive if the coal costs are figured over a fair period of years.

"In Chicago not much electricity business came to the Commonwealth Edison Company directly as the result of coal shortage and high coal prices among isolated plants. The fact that coal prices fluctuate and upset carefully laid estimates of industrial earnings has been called to the attention of industrial plant owners, however, not only by their own balance sheets but by the direct-by-mail advertising of the central station. The stability of central-station rates has also been pointed out, and it is believed that the ultimate result will be an increased industrial plant business."

GIVING RATES CAREFUL CONSIDERATION, SAYS W. W. FREEMAN

W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati, said: "The cost of our service has been very largely increased by the advance in coal prices during the past three months. Such increased expenses have been out of all proportion to the increased earnings. I believe that our position in this matter is no different from that of practically every electric-lighting company in the country. I very much doubt that the abnormal prices which we have had to pay for coal will be continued very long, but I do believe that coal will permanently be more costly than was the case a year ago and previously. This may make it imperative to readjust the rates for electric power service. We are giving the matter careful consideration with a view to meeting the probable future conditions in a manner fair to all concerned."

SITUATION IMPROVING IN DULUTH

Speaking for the Duluth Edison Company, C. E. Van Bergen, the secretary of the company, said: "While we buy most of our energy from the Great Northern Power Company—a hydroelectric property—we have had hard work to get what coal we need for our auxiliary steam plant and for our steam-heating business. We ordinarily carry on hand as a reserve about 1000 tons, but our stock of late has been reduced to under 200 tons on account of the shortage of cars. The only cars we get are ore cars, gondolas, or old flat cars with temporary sides built on them. There are no box cars. During February we received less than 250 tons of coal, but in the first three days of March we received five cars of coal, so the situation seems to be improving."

CONDITIONS AS VIEWED BY BYLLESBY COMPANIES

While the high coal prices had a serious effect on the net income of the properties of H. M. Byllesby & Company, the difficulties in securing sufficient coal have not been at all serious. This lack of difficulty is attributable to the company's plan of handling its coal purchases and to the proximity of many subsidiary companies to coal mines. Coal for its companies in the Northwest is delivered from the east to the head of the Great Lakes before navigation closes. By anticipating the car shortage and laying in large stores of this coal at the plants, the Byllesby operating companies in Northwestern cities were assured of an adequate supply. At no time was any plant within ten days of shutdown. In Oklahoma the Byllesby plants burn gas; in California they use oil; at Louisville (Ky.), at Ottumwa (Iowa), and at Pueblo (Col.), the coal fields are near at hand.

R. G. Hunt, assistant to the vice-president in charge of operation for the Byllesby company, believes that coal prices will return to their normal level. He said when the present war prosperity is over there will be a readjustment of labor prices. Factories that have been operating three shifts will lay off two of them. The formerly unskilled laborers, who have of late been educated in the factories, will become competitors of men who were the former skilled workmen. Prices of factory labor will be forced down. There will be a dearth of common labor, however, which will be aggravated by the return to Europe of many men who will return with their savings to help relatives rebuild their fortunes. The states that are now legislating to exclude the Japanese common laborer will see their folly for he will be the man they will need. With such readjustments taking place coal prices will come down. They may not recede as much as prices of other commodities on account of labor shortage in the mines, where there are many foreigners.

Mr. Hunt said that while the power business has increased materially, it is wrong to attribute the increase to the fuel or isolated plant machinery situation. Most of the power business has been obtained because of the continuous activity of the companies' sales departments.

VIEWS OF MR. GASKILL

D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company and secretary of the Ohio Electric Light Association, says:

"The effect of this winter's coal situation is a very appreciable one in the operating expenses of the Ohio companies. Nearly all of the companies report an increase of about 300 per cent in fuel cost for this winter's operation. So serious has this become that conferences are now being held looking toward a united action in raising the power rates to meet this situation. This extra cost has not affected the service of the companies in that all of them have maintained service at whatever cost it entailed.

"In our particular case we have been singularly fortunate in that we started in the winter with a very large stock of storage coal, and having dealt continuously with the same firm for eighteen years they have kept up their shipments on our regular contract very fairly. In fact, they are now 100 per cent on their contract. In our Eaton property we have not been so fortunate and have had to buy some high-priced coal.

"The situation at this time is becoming easier. Some of the companies report that their regular contract men have resumed shipping to them on a 100 per cent basis. It is probable that the situation will very materially ease within the next thirty days, but the coal prices will not drop back to low figures until probably the year 1918."

INFERIOR COAL IN OMAHA

H. A. Holdredge, general manager of the Omaha (Neb.) Electric Light & Power Company, said: "We were obliged to pay in December an average price for coal which exceeded the former December price by 35 per cent; the average price in January exceeded that of the previous year by 26 per cent; the February average price exceeded that of the previous February by 16 per cent. In addition to this we were obliged to use large quantities of coal that was far inferior in quality to that which we obtain under normal conditions."

ACTIVE WORK OF THE N. E. L. A. COMMERCIAL SECTION MEMBERS

Meetings Held in New York This Week by the Electric Range, Merchandising and Executive Committees in Preparation for the Annual Convention

The committees of the Commercial Section of the National Electric Light Association are very actively at work completing their convention papers and reports. The electric range committee, with twenty members present, met at association headquarters in New York on Monday, March 5. The meeting lasted all day Monday and Tuesday, adjoining at 9.30 o'clock on Tuesday evening. The committee reviewed all of the subcommittee reports to be presented at the convention. Mr. C. E. Michel of the Union Electric Light & Power Company, St. Louis, Mo., is chairman of this committee.

The merchandising committee, of which J. V. Guilfoyle of the Western Electric Company is chairman, met at association headquarters on Tuesday, March 6. Two of the sub-committees submitted their convention reports, which were discussed in detail. The principal topic discussed was electrically equipped furniture and plans for exhibiting some such furniture at the Atlantic City convention.

The executive committee of the Commercial Section held an all day session on Wednesday, March 7, with sixteen members present. Reports were received from all standing committees. Special interest was shown in the report of the committee on compensation of salesmen, and it was decided to recommend to the next administration that this committee be continued next year as a consulting bureau, many of the member central station companies having shown great interest in this subject.

January	Better lighting
February	Outdoor lighting (tennis courts, playgrounds, etc.)
March	Stores and windows
April	Residence lighting
May	Electrical advertising (signs, outline lighting, display lighting)
June	Public building lighting
July	Industrial lighting
August	Stores and windows
September	Electrical advertising (signs, outline lighting, display lighting)
October	Residence lighting
November	Better lighting—with emphasis on office buildings
December	Industrial lighting

Chairman Pembleton of the publications committee reported that the booklet on wiring of old houses, "Electricity in Your Home," was completed and copies had been sent to all central station members of the association. Orders are being received for this booklet at the following prices: f.o.b. New York including imprinting company name and address on booklets: 25,000 and up, $26.15 per 1000; 20,000, $26.55 per 1000; 15,000, $26.95 per 1000; 10,000, $27.35 per 1000; 5000, $27.75 per 1000; 2500, $28.15 per 1000; 1000, $29.00 per quantity; 750, $23.25 per quantity; 500, $16.50 per quantity; 250, $8.75 per quantity; 100, $3.65 per quantity.

Mr. Pembleton also advised that the booklet on wiring of new homes will be ready for distribution on March 15 and that samples will be sent to all Class A members with order blank. A meeting of this committee will be called for the latter part of the month, when dummies of the 1917 Christmas booklet will be presented. It is planned to have samples available by the time of the Atlantic City convention.

Chairman Jones of the power sales bureau reported that the American Electrochemical Society had appointed a sub-committee of three members, to meet with a sub-committee of the power sales bureau in the development of electrochemical work.

Chairman Kelly of the lighting sales bureau presented a progress report, mentioning especially the schedule suggested by the Bureau to fit in with the merchandising schedule of the committee on co-ordinate advertising and sales campaigns. [This schedule is published in the preceding column.]

Both the power sales and lighting sales bureaus reported that they are planning get-together dinners at the convention so that the lighting and power men in attendance may become better acquainted and discuss their problems in different parts of the country.

Upon invitation Charles H. Lum, assistant to the general manager of the National Board of Fire Underwriters, and Joseph B. Forsyth, chief inspector of the New York Board of Fire Underwriters, met with the executive committee at luncheon to discuss the subject of fire hazard resulting from the careless use of electrical appliances. These gentlemen indicated that in their opinion such appliances were not only remarkably safe but that the electrical industry and the N. E. L. A. especially, had rendered the most valuable hearty cooperation with the Underwriters. The suggestion was made by Mr. Lum that a sub-committee of the Association be appointed to co-operate with a sub-committee of the Underwriters to carry on this important work for the education of the public.

CHANCES OF EXTRA SESSION OF BOTH HOUSES OF CONGRESS

Present Prospect Is That President Wilson Will Not Call the Two Branches Together Before June—Conservation and Webb Bills Lost in the Filibuster

It appears likely now that an extra session of Congress will not be called by President Wilson before June. The President changed his original intention, which was not to call the Senate in extraordinary session, and that body is now assembled in Washington.

There is a likelihood that the Senate will revise its ancient rules which have allowed unlimited debate and under which it has been necessary to do business by unanimous consent rather than by majority rule. If it changes its rules so as to limit debate and provide for a vote and action by the majority, there is a possibility that an extra session of both Houses of Congress may be called before June. This would be primarily for the purpose of acting on foreign affairs, but if there is a joint session of both bodies, with Senate debate limited, such a condition would make for favorable action on water power bills and the Webb bill which permits combinations in export trade.

President Wilson in a statement to the American people the beginning of the week drew attention to the importance of the legislation before Congress which has been advocated by the business interests, such as the conservation bills, the Webb bill, etc. It is not doubted that if there is an extra session of both Houses the President will urge this business legislation as well as the foreign legislation he desires.

The present appropriations expire June 30, the end of the government fiscal year, and if both Houses are called by June 1, it is believed that the month to the last of June would be sufficient for appropriation legislation.

It is still doubtful whether the Republicans or the Democrats will organize the House, a question on which important committee chairmanships hinge. One Democrat, however, died recently, and there are now 215 Republicans, and 214 Democrats, with 5 Independents, to go into the House, with the possibility of complication by other deaths.

FUTURE OF THE ONTARIO HYDROELECTRIC SYSTEM

Sir Adam Beck Says It Must Absorb All Other Electric Systems in Province—He Expects the Commission and Municipal Investment to Be $100,000,000 Within Five Years

In an address before the Ontario Municipal Electric Association on Feb. 15, Sir Adam Beck reviewed the work of the Ontario Hydro-Electric Power Commission and spoke on the future of the provincial system. The commission at present supplies 191 municipalities, and expects to supply over 200 in the course of the next two or three months. Over 200,000 hp. is now developed by the commission, with a total investment on the part of the commission and municipalities of more than $40,000,000. Within five years Sir Adam expects this amount to increase to $100,000,000.

In regard to the future Sir Adam said in part as follows:

"The Chippawa development is merely the foundation of the beginning of greater things. My own opinion is that the hydroelectric power system must absorb the whole of the electric systems in the province of Ontario, and I hope it will begin at Niagara Falls. If that policy is carried out there will be no difficulty in making available 1,000,000 hp. by using only the waters we have a right to use under the treaty.

"Our regret is that the eastern district has not been included, as it were. The eastern district will be in as advantageous a position and in a more wealthy district as soon as the deepening of the waterway from Lake Ontario to Montreal is undertaken by the Dominion government. Then it should not be a very difficult matter. I know the State of New York, and if not New York a private enterprise, is ready to undertake half of the capital cost of building dams that will be necessary to make the St. Lawrence a deep waterway."

PROTEST AGAINST CANADIAN WATER DIVERSION AT NIAGARA

Formal Presentation of Claim That Proposed Chippawa-Queenstown Power Canal by Ontario Hydroelectric Commission Would Violate Treaty

Formal protest has been made to the Canadian government by the United States against the proposed Chippawa-Queenstown power canal by which the Ontario Hydro-Electric Commission will divert additional water from the Canadian channel of the Niagara river for power development. The United States claims that the project would violate the treaty under which the diversion limit above the cataracts is fixed at 20,000 cu. ft. per second on the American side and 35,000 cu. ft. per second on the Canadian side.

The Ontario provincial legislature has been advised by Attorney-General Lucas that there is no necessity for seeking the consent of the International Joint Waterways Commission to carry out the Chippawa-Queenstown power development project and, acting under this advice, the provincial legislature will proceed with the plans without the permission of the international commission. Surveys for the canal have been completed and excavations will be started in the early spring. The canal will start at the village of Chippawa near Niagara Falls, Ont., and will parallel the upper river and lower Niagara gorge to Queenstown, Ont., where gigantic power generating plants will be constructed. The Ontario Hydro-Electric Commission is handling all plans and construction and operation details.

LARGE GAIN IN DAYTON COMPANY GROSS EARNINGS

Policy of Extending Transmission Lines Gives a Total of 36 Cities, Towns and Villages Served—President Tait Confident of Satisfactory Business in 1917

Gross earnings of the Dayton (Ohio) Power & Light Company for the year ended Dec. 31, 1916, were $1,613,873, a gain of 46.98 per cent over 1915; operating expenses were $999,961 while net earnings amounted to $613,912, a gain of 18.4 per cent over 1915.

President F. M. Tait, in reporting to stockholders, describes the extensions of transmission lines during the year, aggregating a total of 48 miles, of which 12 miles are of steel tower construction. The villages and towns added by these extensions make a total of 36 cities, towns and villages supplied. Mr. Tait adds:

"An analysis of our 1916 operation shows an increase of 3989 in the number of consumers connected to our lines, making a total increase in connected load of 16,511 hp. The past year has been an abnormal one in many respects and particularly noticeable in the large increase in the operating expenses of the company, brought about chiefly through the high cost of coal and materials. It is not expected that the company's business in 1917 will be adversely affected by the return of more normal industrial conditions and it is confidently expected that the business for the year 1917 will be satisfactory."

GAINS BY PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

Increases in Both Gross and Net Earnings—Particulars of Extensive Construction Work—Large Amount of Material on Hand

Notwithstanding higher costs of operation, the Public Service Company of Northern Illinois increased both gross and net earnings in the year ended Dec. 31, 1916. Much construction work was completed during the year or is under way. The income account follows:

	1915	1916
Gross earnings	$6,903,228	$7,783,156
Operating revenue from electricity, gas, heating and water	6,244,477	6,862,988
Merchandise sales and other income	658,750	920,168
Expenses (including taxes)	3,749,370	4,508,483
Operating for gas, electricity, heating and water	3,200,917	3,740,885
Merchandise department	548,452	776,597
Net earnings for the year	3,153,857	3,274,673
Deduct—bond and note interest	1,492,280	1,497,818
Net income for year	1,661,577	1,776,855

Electric customers were 75,900 in 1916, as compared with 64,540 in 1915 and 54,850 in 1914.

In his report to stockholders Samuel Insull, the president, said:

"The year was characterized by an increased cost of operation due to the high price of coal, oil and other materials as well as to the greater cost of labor. But this increased cost of operation is not reflected in the earnings, as a satisfactory ratio of net earnings has been maintained by reason of the large increase in gross income.

"Following its policy of reducing rates to customers when it is practicable and safe to do so, the company lowered its rates for both electricity and gas during the year.

"As authorized by the State Public Utilities Commission of Illinois, the company, on June 1, 1916, reduced

its maximum rate for lighting from 12 cents (net) a kilowatt-hour to 11.5 cents (net). On Oct. 1, 1916, this rate was still further reduced to 11 cents (net) a kilowatt-hour, the secondary rate being 7 cents (net). These rates are effective throughout nearly the entire territory of the company.

"In several cities and towns a general gas-service rate was put into effect during 1916. This rate is $1 (net) for the first 1000 cu. ft. of gas consumed in any month; 90 cents (net) each for the next 2000 cu. ft., and 80 cents (net) per 1000 cu. ft. for the excess over 3000 ft. consumed in any one month.

DEMAND SYSTEM IN GAS RATES

"On April 13, 1916, a wholesale gas-service rate was put into effect. This rate is based on the demand system of rate making which years of experience in the electric service utility have shown to be correct. The Public Service Company of Northern Illinois was one of the first companies in this country to apply the demand system to gas rates. The new wholesale gas-service rates are divided into two parts—a demand charge based on the maximum demand in cubic-foot-hours in any month and an output charge, being an additional charge for all gas used, based on the cubic feet of consumption in any month. By the adoption of this modern and equitable system of rate-making it is expected that the company will secure a large amount of industrial gas business.

"With the decrease in customers' rates for both gas and electricity, there was an increase in the dividend rate paid on the common stock. On Nov. 1, 1916, this dividend rate was increased from 6 to 7 per cent per annum.

CONSTRUCTION WORK

"Fairly satisfactory progress was made during the year in the construction of the large electric generating station 3 miles south of Joliet; but much delay was encountered on account of the non-delivery of material. The building under construction will contain two 10,000-kw. electric generating units. The first of these will be ready for operation in the spring of 1917, and an order has been placed for the delivery of the second 10,000-kw. unit next October. As planned, the ultimate rating of this station will be 60,000 kw., and it is probable that the next unit installed will be a 20,000-kw. unit.

"The large electric generating station at Blue Island has a present rating of about 25,000 kw. An additional 12,500-kw. unit was practically finished during the year and is ready for service. Another generating unit of the same size is to be installed during 1917. Additional land adjoining the Blue Island station property was purchased to provide for these extensions. A new steel-tower transmission line of 8000 kw. capacity has been built to connect with the Commonwealth Edison Company's lines at the southern city limits of Chicago.

"In Joliet a new electric substation is under construction. It is capable of serving as a center for the distribution of 10,000 kw. of electrical energy. It will be supplied by two 12,000-volt circuits from the new Joliet generating station. These circuits will be partly underground and partly supported on steel towers 65 ft. high. In the vicinity of the new Joliet electric generating station about 28 miles of new 33,000-volt transmission lines are now under construction. These new transmission lines will connect the new station with the present network of electric transmission and distribution circuits. They will ultimately carry about 50,000 kw. of electrical energy.

"A new 33,000-volt electric transmission line between Pontiac and Streator generating stations is nearly finished. The section between Streator and Cornell is ready for service, and it will enable the Cornell generating station to be shut down, twenty-four-hour service being supplied for that town.

"A new transmission line, upon which work was started in September, 1916, between the Waukegan generating station and the Lake Bluff station, is in service. This line is built of standard 33,000-volt construction, and it will materially improve operating conditions in the northern division.

"The company has provided itself with a larger amount of material in its storerooms than is usually carried on hand. This precaution was taken owing to the difficulty experienced in getting material from the manufacturers."

LOS ANGELES RESCINDS PLAN TO BUY PRIVATE SYSTEMS

Arrangements for Charter Amendment Election Withdrawn and New Propositions, Involving Purchase, Wholesale Disposal of Power, or Paralleling of Existing Systems Are Considered

The Los Angeles City Council on Feb. 21 rescinded all steps toward holding a charter amendment election on March 8, which would enable the city to purchase the distributing systems of two private companies. In place of the scheme thus abandoned, the Council debated the advisability of submitting to the people three direct propositions, namely: Shall the city purchase the distributing systems of the two power companies? Shall the city wholesale its power to the power companies? Shall the city parallel existing distributing systems?

The reasons which led to this action, according to a declaration made by the Council, are that "after three months of negotiations with the two companies, the city has been unable to secure from them a contract for the sale of their distributing systems in accordance with the offer made in writing by the city Nov. 29, 1916, and the outcome of negotiations in relation to the contract which the proposed charter amendment is intended to validate are at this time entirely uncertain."

Councilman Conwell commented on the situation as follows: "The committee of three negotiating with the companies has endeavored to iron out the points of difference between the Council and the proposed contract. I feel convinced that the extreme limit to which the Council would go in an effort to meet the demands of the companies would not be acceptable to them.

"We might grant the ten-year conditions, but the thought of tying the city, either directly or indirectly, to a hard and fast contract to buy power for a period of twenty years succeeding the ten would, in my opinion, never be acceptable to the electorate.

"That the contract as formulated by the experts is financially favorable to the city, I admit. At the same time I hold that the maintenance of a principle is more important than financial gain. The principle is the right of the city to govern its own affairs, free from entangling contracts for a long period of years.

"I am a believer in municipal ownership under proper conditions, but those conditions involve monopoly of the utility, whereas this entire arrangement would leave in the field an active competitor whose ability and financial strength cannot be questioned.

"Moreover, we know that that competitor is in possession of a steam plant and 14-cent gas—a combination which, applied through modern means, will produce electric energy at a cost dangerously near the cost of hydroelectric generation with transmission. [The Midway Gas Company delivers 1000 B.t.u. natural gas to

the Los Angeles Gas & Electric Company at city limits for 14 cents per 1000 cu. ft. This gas can be used as fuel at the steam plant.]

"Aside from all considerations, it appears to me that this is an inopportune time to vote bonds for any purpose. National and international affairs interfere, and, lastly, the attitude of our electorate toward its officials is not, to say the least, of a nature to inspire confidence. Upon the whole, therefore, it would seem the better part of wisdom to postpone the matter until the situation clears, in the hope that we may in due time conclude an arrangement whereby the city may come into possession of the distributing systems of all three companies."

The action of the Council came as a surprise to the Public Service Commission, according to statements of members of that body, but the commission still plans to continue negotiations in the hope of bringing the matter to a successful conclusion.

QUESTION INTER-COMPANY AND BANKING LOANS IN NEW YORK

Transactions Between Consolidated Gas Company and Subsidiaries and Loans to National City Company Investigated by Public Service Commission

A letter has been sent by the New York Public Service Commission of the First District to George B. Cortelyou, president of the Consolidated Gas Company of New York, asking for information in reference to about $9,000,000 loans made by subsidiaries to the National City Company. The subsidiary companies mentioned by the commission are the New York Edison Company, the United Electric Light & Power Company, the New York & Queens Electric Light & Power Company and the Astoria Light, Heat & Power Company.

LETTER OF THE COMMISSION

The letter of the commission, signed by James B. Walker, the secretary, says:

"From the company's annual report to the commission for 1915, it appears that after providing for the payment of short-term notes and other obligations, there remained approximately $9,000,000 of cash proceeds of debentures for which the company had no immediate use, and that on or about Feb. 15, 1915, the company, principally through certain subsidiary companies in the First District, loaned $9,000,000 to the National City Company at interest rates varying from 2.8 per cent to 3.05 per cent."

REPLY FOR THE COMPANY

On behalf of the Consolidated Gas Company a statement was made, in effect as follows:

"Obligations of the company were created to finance construction requirements of subsidiaries, which have been financed by the Consolidated Company for 17 years past. Construction requirements were anticipated and the burden of carrying the funds properly belonged to the subsidiaries. Stagnation has reduced output below expectations; otherwise larger expenditures would have been made and cash balances greatly reduced. Companies are obligated to have facilities equal to maximum demand and it is vitally important that they should be in sound financial condition at this time. The companies are exceptionally fortunate in obtaining so satisfactory a rate of interest on funds which they were obliged to carry, in part at least, longer than was anticipated. No company under the jurisdiction of the commission obtained any higher rate on loans.

"WE ASK ADJUSTMENT OF ALL EXISTING DIFFERENCES"

Plea of A. D. Mackie, General Manager of Springfield, Ill., Companies, Which Are Asked for Improvements While Franchises Are Expiring

A statement issued by A. D. Mackie, general manager of the Springfield (Ill.) Gas & Electric Company and the Springfield Consolidated Railway asks for an extension of the franchises for electric and heating service, which expire in 1921.

To carry out improvement plans of the city commission would involve expenditures by the companies in the downtown district alone of $738,003. Of this $312,670 would be for underground wires, $267,613 for the electric railway's share of street paving and ornamental lighting system and for railway construction work on repaved streets in the downtown district, and $157,720 for replacement and overhauling of steam, hot water and gas mains on repaved streets in the downtown district. Other necessary expenditures, costs and incidentals would increase these figures. The improvements are desired in connection with the centennial which is to be celebrated by Springfield next year. Mr. Mackie says that it will not be possible to incur the obligations necessary for the improvements if they are to be of use to the companies for only three years. He adds:

SAVE DEFENSE COST AND REDUCE RATES

"We ask an adjustment of all existing differences. We believe that the large sums which we have been compelled to expend, almost annually, during more recent years, to defend our right to do business, could better be used for rate reductions to our customers. We believe that the loss of revenue which would come to us in such reductions would largely be offset by closer friendliness and co-operation on the part of the general public. We believe that every citizen would be a gainer by a satisfactory settlement of the long-continued and vexing struggle in which we have been involved.

"In connection with the extension of our license by the city we are willing to make reasonable rate reductions which would apply not only to electricity but to gas and which would mean that cheaper current and cheaper gas would be at once available to every consumer in Springfield. We sincerely believe that immediate and general rate reductions, both of gas and electricity, necessarily would be of far larger advantage to the people as a whole than any that possibly could come to them through a system which could provide cheaper electricity only to a limited few and which could not be available to a majority of consumers for very many years to come and then only through vast expenditures of public funds.

"We are willing that the extension of our license shall include the stipulation that the city can take over our electric light and power plant at the end of any five-year period at a price to be determined either by arbitration or by condemnation proceedings. We believe that the fairness of this proposition must be apparent to everyone and will again demonstrate the lack of any just reason for a continuation of the attacks to which we have been subjected.

"We would add that, so far as our proposed underground wire system is concerned, we are not asking and have not asked the city to place its wires in our ducts. On the contrary, we are quite willing that the city shall dispose of its own wires in such manner as it may see fit. We did suggest that which must be obvious to everyone, that a duplication of underground duct systems means an unwarranted duplication of expense and an unnecessary congestion of subsurface conditions."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Anticipation of Highways Being Used for House Moving.—The Empire District Electric Company maintained across a public road a system of poles and wires, including two telephone wires and a ground wire which were 19 ft. above the roadway, and two high-tension wires, uninsulated, charged to 33,000 volts, and which were suspended 23 ft. 3 in. above the highway. The Supreme Court of Kansas held in the case of Logan versus the company (161 P. 659) that it was the duty of the company to anticipate the moving of buildings of greater height than the wires and to take precautions to protect persons liable to be on such structures from danger of coming in contact with wires. The mere fact that wires operated at such a high tension could not be insulated would not preclude the right of the plaintiff to recover on the ground of negligence charged, namely, a failure to place the wires high enough to avoid interference with the lawful use of the highway.

Contract by Implication.—The City of Sonora, Cal., by ordinance, provided that electric energy, except for street lights, should be furnished for twenty-four hours daily, and for street lighting for a stated period each night. The Tuolumne County Electric Power & Light Company wrote the city that to comply with this ordinance it would be necessary to leave power on its former night circuit for twenty-four hours and that it would be necessary for the city to turn off the street lights belonging to the city which were attached to such circuit, during the day, or the city would be charged for power used in the street lamps during the day, and that the obligation of the company ceases when it furnished power to the city's connection. The city replied that it would only pay for energy furnished at the time and in the manner required by the ordinance, unless otherwise specifically requested, that the obligation of the company was to furnish power at the time and in the manner required in the ordinance, and that its obligation did not cease when it furnished power to the city's connection. The District Court of Appeals of California held (161 P. 128), and a rehearing was refused by the Supreme Court that regardless of the question of whose duty it was to furnish appliances to prevent the waste of electricity, the company could not recover for electricity used in the city's street lighting system during the daytime on the theory that its use created an implication that the service was performed at the instance and request of the city authorities.

Damages from Water Flowage.—A person whose property was flooded by a power company was entitled to adequate damages for the injuries sustained under the circumstances shown, it was held by the Supreme Court of Michigan in the case of Morrison vs. Queen City Electric Light & Power Company (160 N. W. 434). In such case, it was immaterial whether the power company actually contemplated the damages which resulted or not, since the court showed that it must be held to contemplate all the damages legitimately following from its wrongful act. However, it was the duty of the plaintiff to minimize the damages occasioned by the flooding of his property, and having failed to do so, he could recover only such damages as would not have been avoided by so doing; and he should have made an honest endeavor to reduce the damages by changing and improving the property, as had been suggested. A party is always entitled to recover the legitimate expenses incurred by him in an honest endeavor to reduce the damages flowing from or following a wrongful act.

Duty in Furnishing Sufficient Help.—The Supreme Court of North Carolina held (90 S. E. 996) that it was the duty of a telephone company loading poles on railroad cars to have a sufficient force of hands to do the work and make it reasonably safe to perform it. Where the foreman ordered his gang to do work which would expose them to danger and the order was negligently given, so that injury resulted to an employee, he was liable jointly with the telephone company for any injury sustained.

Contributory Negligence in Obedience to Orders.—An interesting case in which some of the fine points about the care to be exercised not only by the employer but by the employees as well according to their duties, was laid down by the California District Court of Appeal in Earl vs. San Francisco Bridge Company (160 P. 570). It was here held that it is negligent for an employer to change the cut-off switch so that it did not entirely cut the current off and then to direct an employee who had previously inserted fuses after cutting off the current at the switch, to insert a switch without warning him that the switch had been changed. Although the employee knew of the danger of working around wires carrying a current with such a voltage he was justified in assuming that the switch would still cut the current off the wires, the difference in its appearance not being so palpable as to come to the conclusion that in the exercise of ordinary care he could have discovered it. Furthermore, an employee who had knowledge that the cut-off switch had been changed so as not to cut off the entire current was not contributorily negligent in attempting to replace a fuse under the direct supervision of the engineer where the change merely rendered the attempt at replacement more dangerous but did not make it inevitably or imminently dangerous.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

New York Commission Objects to Pending Legislative Bills.—On motion of Commissioner Travis H. Whitney, the New York Public Service Commission of the First District has adopted a memorandum addressed to Senator Charles D. Newton, chairman of the committee on codes of the New York State Senate, and to Assemblyman Fred. M. Ahern, chairman of the codes committee of the Lower House, pointing out serious objections to the so-called Martin bills now pending before the Legislature, which relate to review of decisions by certiorari. The memorandum points out that the bills would set aside the recent decision of the Court of Appeals in the New York & Queens Gas Company case to the effect that upon a certiorari the court may not substitute its own judgment for that of the commission. In the memorandum the bills in question are asserted to be "undoubtedly the answer of the public service corporations to that decision. By apparently simple amendments to the code of civil procedure, relating to certiorari proceedings, these bills would greatly impair prompt and effective regulation by the commission, orders of the commission being reviewable by a writ of certiorari. Those bills would set aside the decision of the Court of Appeals in that they specifically provide for a review of the facts."

Distributing Company Must Secure Ample Supply to Give Adequate Service.—In a recent ruling, the Maine Public Utilities Commission declares that the Wiscasset Electric Light Company, which purchases energy from the Portland Power & Development Company for local distribution, must secure an adequate supply for its customers. Residents of Wiscasset appealed to the commission on the ground that service interruptions occurred frequently. The company admitted the fact, but said that it could not secure a regular supply of electricity from the generating company, and had no other available source. The commission states that while the reason advanced for the failure to give reasonably adequate service is based on fact, it does not relieve the company of its duty to the public, and some other means of supplying energy must be sought. Stockholders of the Wiscasset company have interested the management of the Central Maine Power Company in the field and arrangements will be in effect soon by which the distribution of energy locally will be carried out on the basis of transmission by the Central Maine company to Wiscasset, and then retailing by the local company.

Cities Service Company Stock Increase.—Stockholders of the Cities Service Company will be asked to authorize, at the annual meeting on April 3, increases in the preferred stock from $60,000,000 to $100,000,000, and in the common from $40,000,000 to $50,000,000, making the total authorized issue $150,000,000. These increases will provide for future corporate needs.

Municipal Electric Plant Displaced by Central-Station Service.—The Minneapolis General Electric Company has closed a contract with the city of Anoka, having an approximate population of 4000, covering its electric light and power requirements amounting to 300 kw. The city will discontinue operation of its municipal electric plant, but will continue the distribution and sale of electric energy as heretofore.

Amalgamation Recommended for New York Commissions.—The Thompson joint legislative committee recommends that the two Public Service Commissions in New York State be amalgamated. Its report to the Legislature says that consolidation would save $400,000 in "needless salaries." A rapid transit commissioner should be appointed in the First District, but the commission should confine itself exclusively to regulation, the committee holds.

Difficulty in Storing Coal in Stone Quarries.—A Chicago concern, which experimented during the winter with a plan of storing soft coal screenings in abandoned stone quarries at Kankakee and Lemont, Ill., met an unexpected difficulty. The coal in the quarries was covered with water to prevent fire. To remove the coal a suction pump was employed. The coal did not ignite, but when it was most needed it was under a foot of ice. When the coal was pumped into the cars, much of the water froze, making the car load a body of ice and coal dust. Further experiments are likely to be made to develop a successful method.

Street Lighting Improvements in San Diego, Cal.—The San Diego Consolidated Gas & Electric Company recently removed from its lines the last remaining arc lamps used in municipal or public lighting. Two years ago the important lighting was effected by means of arc lamps, but these have now all been replaced by incandescent units. The main lighting of the city of San Diego and adjacent communities is by means of 600 cp. Mazda C Novalux refractor units. Of these there are now installed a total of 979, and there are also in suburban towns 418 smaller units varying in size from 40 to 400 cp. The business district is illuminated by 539 five and seven-light electroliers containing 3255 multiple lamps of 60 and 100 watts, and there are 159 single-light electroliers containing 250 cp. Mazda C lamps. The first installation of higher candlepower Mazda C units was completed in May, 1915, when 700 units were placed in San Diego. This installation has proved so successful that a replacement of arc lamps followed as rapidly as contracts expired.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Dry Laws Turn Breweries Into Electrically Operated Ice Plants.—In some states where legislation has prohibited the manufacture of beer, the brewers are remodeling their plants and operating them electrically as artificial ice plants.

Radio Station for Porto Rico.—The Senate Committee on Naval Affairs in reporting the Pagett Bill making naval appropriations for the coming year recommended increases aggregating $167,000,000. One of the items in this increase was one for $400,000 for a radio station at Porto Rico.

Ohio Senate Committee Favor Gilmore Bill.—The public utilities committee of the Ohio Senate has approved the Gilmore bill, which requires a company to secure from the Public Utilities Commission a certificate of public necessity before it can invade a municipality where a similar utility is already in operation.

Storm Damage in Kentucky.—Severe snowstorms have been doing a great deal of damage to electric wire systems throughout Kentucky. In Louisville many lines were broken, while all over the State there was much of the same kind of trouble. Telephone and telegraph companies were hit the hardest, although electric light and power systems suffered damage. Companies had difficulty in finding linemen capable of making repairs.

Cold Weather and Lack of Fuel Results in Big Demand for Electric Heaters and Equipment at Cleveland.—Dealers in Cleveland report a big rush for electrical heaters during the recent cold spell. The mercury stood below zero much of the time, and there were neither gas nor coal to be had at any price in many homes. Cooking devices were also sold in large numbers. Some dealers said their stocks ran very low on these things for a time and it now appears that many people will have them on hand in the future, even if they do not make use of them regularly.

Amendments to Meter Test Regulations in District of Columbia.—The Public Utilities Commission of the District of Columbia has amended the regulations for electric service in the district so far as they pertain to the intervals between tests of meters, as follows: Single-phase meters up to and including 25 amp. rated capacity, at least once in every thirty-six months; over 25 amp., at least once in every twenty-four months; polyphase meters up to and including 50 kva. rated capacity, at least once in every twenty-four months; over 50 kva. rated capacity, at least once in every twelve months.

Monthly Publication for Toledo "Rail-Light."—A monthly publication for employees, to be issued under the direction of E. R. Kelsey, advertising manager, is recommended to President Frank R. Coates by the safety department of the Toledo Railways & Light Company and the executive committee of the company's section.

W. S. Barstow & Co., Inc., Retain Control of Pennsylvania Utilities Co.—It is announced by W. S. Barstow & Company, Inc., that E. L. West, president of the W. S. Barstow Management Association, Inc., has assumed personal control of the operations of the Pennsylvania Utilities Company, Easton, Pa., and its associate companies. The company states: "Mr. West will continue to direct the business policy of the companies and the development and expansion of their properties on an absolutely dependable and efficient basis, in keeping with the high character of service it is desired to furnish. No change in the control or ownership of the companies has occurred or is contemplated, and they are on a sound financial basis. The General Gas & Electric Company and W. S. Barstow & Company, Inc., still retain their interests, and adequate financial support is absolutely assured."

Toledo Company May Take Over Municipal Plant at Monroe, Mich.—A special committee of eighteen citizens, appointed by the Mayor of Monroe, Mich., recommends the acceptance of the offer of the Toledo Railways & Light Company to supply service, supplanting the municipal plant. The committee was appointed to review the advisability of financing improvements in the municipal plant and obtain proposals from the Toledo company and the Detroit Edison Company. After several weeks of investigation the committee made its report. If this is ratified by special vote of the citizens, the Toledo company will take over the municipal plant. At present the company supplies some power to consumers in Monroe, and recently it secured a contract for 1500 h.p. Monroe has about 1100 meters. A. K. Young, new business manager, sees a promise of large future business.

Telephone Inquiry for Massachusetts.—An exhaustive inquiry into the rates, finances and relations of the New England Telephone & Telegraph Company with the parent Bell organization is presaged by a vote of the Massachusetts Senate on Feb. 19 appropriating $15,000 for the Public Service Commission's use in this connection. The last telephone rate inquiry in the State took place in 1909 by the Highway Commission. For the past two or three years the Public Service Commission has sought an appropriation for this special purpose. Last year the company opposed an inquiry on the ground that the time and energies of its executives were entirely occupied in providing for the service demands growing out of the business boom following the outbreak of the European war. Purchasing and licensee relations will receive special consideration.

Minneapolis Jovians Hold Banquet.—On March 8 the Jovians of Minneapolis held the largest "get-together" banquet they have ever had, over 200 being present.

Los Angeles Synchronous Club.—At the March 1 meeting of the club, Leo Keller, chief engineer of the Home Telephone Company, read a paper on "The Telephone Consolidation." Following him, H. N. Beecher, chief electrical inspector for the city of Los Angeles, spoke on "The Electrical Code."

Indicating and Watt-Hour Meters.—E. L. Brown of the General Electric Company delivered a lecture on Feb. 28 before the electrical engineering class of the Worcester Polytechnic Institute on the subject, "Indicating and Watt-Hour Meters." This was the fifth lecture in the electrical engineering non-resident series.

Portland Contractors' Outing.—The Electrical Contractors of Oregon met in Portland on Feb. 21 for their annual "High Jinks." The entertainment committee, headed by Sam C. Jaggar of the Morrison Electric Company, Portland, chartered Crown Point Chalet, on the Columbia River Highway, where the festivities were held. Covers for the banquet were laid for 150.

Monthly Luncheon of Jovian League of New York.—Hon. Joseph Hartigan, commissioner of weights and measures of New York City, addressed the Jovian League of New York at its monthly luncheon on March 7 on the subject "Is there a Food Crisis in New York City?" The speaker discussed the present food prices, the chances of further increases, and the recent food riots. A business meeting was also held.

Associated Engineering Societies of St. Louis.—Under the auspices of the St. Louis Branch of the American Institute of Electrical Engineers the Associated Societies of St. Louis, Mo., held a joint meeting on Feb. 28, at which Howard B. Shaw, member of the Public Service Commission of Missouri, delivered an address on "Rates for Electricity Supply."

American Association of Engineers.—The American Association of Engineers at Chicago has received application for a charter for a local chapter at the University of Illinois. The application was signed by twenty certified and student members at the university. This will be the first engineering university chapter. The temporary officers are: Chairman, D. R. Norris; secretary, Victor A. Pecchia; treasurer, Harry E. Fisher.

H. L. Doherty Addresses Kansas City Jovians.—At the meeting of the Jovian Electric Club of Kansas City on Feb. 16 at the Sexton Hotel, H. L. Doherty, reigning jupiter of the National Jovian Order, spoke on the gas situation, and W. S. Woodland, head of the safety and service department of the Kansas City Railways Company, spoke on the safety placard work he is conducting in the public schools. Several reels of moving pictures were shown along the safety idea by the Kansas City Railways Company.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Causes of Prosperity.—George E. MacIlwain addressed the Schenectady section of the American Institute of Electrical Engineers, March 2, on the subject "Real Causes of Prosperity."

New England Section, I. E. S.—The New England Section of the Illuminating Engineering Society held its March meeting on March 7 at the Massachusetts Institute of Technology, Cambridge, Mass. Prof. William C. Wickenden delivered a lecture on the "Elements of Illumination."

Mobile Armaments.—Andrew M. Coyle, M. E., will give an illustrated lecture on "Mobile Armaments" at a meeting of the New York Section of the A. S. M. E. on March 13. Mr. Coyle is connected with the Coast Defense Board of Engineers, U. S. Army, and is therefore well qualified to talk on this subject.

Undeveloped Sources of Power.—Dr. Charles S. Howe, president Case School of Applied Science, addressed the March 1 meeting of the Electrical League of Cleveland, Ohio, on "Undeveloped Sources of Power." The club held a special entertainment and party on March 2. Motion pictures entitled "A Trip Through the Ford Factory" were shown, being followed by music and dancing.

Convention of the Southwestern Society of Engineers.—The first convention of the recently organized Southwestern Society of Engineers was held at El Paso, Texas, on March 8, 9 and 10. Several interesting papers were read, of which two were "Engineering Education, Its Purpose and Necessity," by Dean Butler of the University of Arizona, and "Engineering In National Defense," by Lieut.-Col. Walker of the U. S. Army.

Toledo Association Members Form Joint Section.—A new joint section has been formed in the Toledo Railways & Light Company, consisting of employees who are members of the National Electric Light Association, American Electric Railways Association, National District Heating Association and the American Gas Institute. The section will have 318 charter members. The officers are: T. J. Nolan, president; G. E. Snider, vice-president; Henry Friede, secretary, and A. C. Van Drieson, treasurer.

Pacific Coast Section, N. E. L. A.—The first annual meeting of this newly formed section, announcement of which appeared on page 72 of the ELECTRICAL WORLD for Jan. 13, will be held at the Old Mission Inn at Riverside, Cal., on April 19, 20 and 21. The committees, which have already been at work on their respective reports for some time, are as follows: Commercial, chairman, Stanley Walton, San Francisco; engineering, chairman, J. E. Woodbridge, San Francisco; accounting, chairman, B. T. Story, Los Angeles. The commercial committee includes members from various parts of the territory and is preparing an elaborate report which is expected to occupy an entire day of the convention. The first two days of the convention will be devoted to business sessions, and the third day to a trip and other entertainment features. About 1000 members had been enrolled in the new organization prior to March 1.

The Engineers' Country Club.—A group of well-known engineers has organized the Engineers' Country Club and, through the Engineers' Land Corporation, has acquired about 240 acres of highly-cultivated and cleared land on the north shore of Long Island, New York, near Roslyn. The properties, which will be quickly developed into what promises to be one of the most complete country clubs in the United States, include the Powell and Duryea farms and the old Villetts manor, one of the historic Long Island homes, dating back to Revolutionary times. Engineers by profession, members of engineering societies and those closely allied with the engineering profession are eligible for membership. Charles F. Quincy of New York is the president of the club. The club has issued a booklet illustrating and describing its properties and explaining its plans. N. M. Garland, 30 Church Street, New York, is chairman of the membership committee.

Southwestern Society of Engineers.—An engineering association which has been named the Southwestern Society of Engineers, has been formed in the southwest to afford engineers in west Texas, New Mexico and Arizona the opportunity of getting acquainted and of co-operating to their mutual benefit. Formation of sections of national societies was considered at first but this was impracticable as there are not enough men available in any one locality to make a strong section. While the new society does not intend to have local sections at present, they may be formed in the future at the larger centers of population. At present the value of the society depends a great deal on securing a geographically well-distributed membership. According to the constitution which has been drafted the objects of the society are the professional improvement of its members, the encouragement of social intercourse among engineers, the advancement of engineering knowledge, education and practice and the maintenance of a high professional standard among its members. There are three classes of membership: Full, associate and affiliated. The constitution provides for semi-annual conventions. Prof. A. F. Barnes, dean of engineering, New Mexico College of Agriculture and Mechanic Arts, State College, New Mexico, is secretary and organizer of this engineering society.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James Coles has been appointed new business representative of the Interstate Light & Power Company at Galena, Ill.

W. Porter Jones, formerly new business manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been appointed manager at Norman, Okla.

R. D. Jennison has been appointed vice-president and general manager of the Pennsylvania Utilities Company, Easton, Pa., and associated companies, to succeed W. D. Ray, resigned. These companies are controlled by W. S. Barstow & Company, Inc.

A. L. Scott, for many years sales manager of the Edison Electric Illuminating Company at Lebanon, Pa., a subsidiary of the Reading Transit & Light Company, because of his ability in campaign work, has been promoted to a specialization in this line. Mr. Scott will conduct his first house-wiring campaign in Reading under the new arrangements in co-operation with H. E. Dawson, commercial sales manager, Metropolitan Electric Company.

L. K. Funkhouser, Dayton, Ohio, has resigned as secretary, treasurer and director of the Dayton (Ohio) Power & Light Company in order to devote all of his time to personal interests. He was connected with the company for the past seven or eight years, starting as timekeeper and clerk. He has been very active in the work of the Ohio Electric Light Association, and at one time was chairman of the accounting committee of the organization.

John A. Hoeveler, recently appointed deputy in charge of lighting with the Wisconsin Industrial Commission, took up his new duties on March 1. After graduating from the University of Wisconsin in the electrical engineering course, Mr. Hoeveler was engaged in illumination design in the offices of Vaughn & Meyer, Milwaukee, Wis., and

JOHN A. HOEVELER

for the past four years has been assistant chief engineer on design and new development work for the National X-Ray Reflector Company. His new work consists of lighting inspection of all places of employment and public building in the State.

N. M. Longbothum has resigned as manager of the Connecticut Power Company at Thomaston, Conn., and accepted a position in the organization of the Winsted Gas Company.

B. F. Hires, Bridgeton, N. J., manager of the Bridgeton & Millville Traction Company, and the Bridgeton Electric Company, and recently acting in a similar capacity for the Electric Company of New Jersey, has been appointed special agent of the American Railways Company, which operates these properties. He will be succeeded by W. J. Kyle as manager.

Benjamin F. Wood, who for sixteen years has been electrical engineer with the Pennsylvania Railroad and for the past three years has served as vice-president and chief engineer of the United Gas & Electric Engineering Corporation, has opened an office in the Woolworth Building, New York, for general consulting practice. He has organized the B. F. Wood Engineers, Inc., which will investigate, design, construct and supervise engineering works and power development, transmission, railroad electrification, electric railways, lighting systems and industrial plants.

Charles F. Gray, consulting electrical engineer, Winnipeg, Manitoba, has been elected controller for the city of Winnipeg for the ensuing year. Prior to opening consulting engineering offices, Mr. Gray was chief engineer in charge of the construction staff of the Canadian Westinghouse Company in the installation of apparatus for the Winnipeg municipal hydroelectric system and the terminal stations and substations in the city. In addition to engineering and construction experience covering twenty years in many Canadian hydroelectric developments, Mr. Gray gained experience in the electrification of the underground tubes in London, England.

Walter S. Gifford, statistician of the American Telephone & Telegraph Company, has, at the request of Secretary of War Baker, been granted a twelve weeks' leave of absence by the telephone company in order that he may act during that time as director of the Council of National Defense, a government body recently authorized by Congress. This council is composed of six members of the Cabinet and is assisted by an advisory committee of seven civilians. Mr. Gifford had previously acted as director of the Committee on Industrial Preparedness of the Naval Consulting Board, at that time a semi-official organization, assisted by the engineering societies of the country. In that capacity he supervised the work of taking an inventory of the industries of the country.

R. Tschentscher, who has been connected for the past thirteen years with the Illinois Steel Company of Chicago, has severed his connection with that company to become general superintendent of the steel plant of the Keystone Steel & Wire Company, Peoria, Ill. The plant will be ready for operation in a short time.

H. W. Brunell has been appointed local manager of the North Western Ohio Light Company's station at Delphos, Ohio. The Delphos station supplies energy to twenty cities located in northwestern Ohio. Mr. Brunell was formerly power engineer of the company, and previously was in charge of the industrial power department of the Pennsylvania Utilities Company.

A. H. Stack has resigned from the Henry L. Doherty Company of New York to become district general manager of the Ohio Service Company with headquarters in New Philadelphia, Ohio.

Obituary

Col. Curtis Vickery Hard, president of the Wooster (Ohio) Electric Company and the Cleveland (Ohio) Light & Power Company, died suddenly at his home at Wooster at the age of seventy-two years. For many years he played a prominent part in the activities of the Ohio Electric Light Association, of which he was president during the 1914-1915 association year. He was born at Wooster in 1845, and received his education at Berea College. A veteran of the Civil War, he was appointed colonel of the Eighth Ohio Infantry at the outbreak of the Spanish-American War, in which conflict he saw service during the entire Cuban campaign and at Santiago. Colonel Hard, with several associates, in 1886 organized the Wooster Schuyler Electric Company, later renamed the Wooster Elec-

C. V. HARD

tric Company, becoming president of the company in 1909. In the meantime he and his son, D. J. Hard, organized the Cleveland Light & Power Company, of which at Colonel Hard's death they were respectively president and treasurer.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MANUFACTURERS OF PLUGS AND SOCKETS BUSY

All Indications Point to a Slight Rise in Prices Shortly, Probably Not More Than 10 Per Cent

An excellent business is being enjoyed by manufacturers of plugs, sockets and similar wiring devices. Jobbers are placing large orders for future delivery. There is an unusual amount of new building of one kind and another in prospect if not actually in the course of construction, as is evidenced by the sold-out condition of the market for building materials. There is also an unmistakable tendency toward a better type of factory illumination in order to better working conditions and increase plant efficiency. All of this is leaving its stamp on the market for electrical fittings to the extent that the demand far exceeds the supply.

Prices are higher than they formerly were, but there is no evidence of a reduction likely to go into effect this year. In fact, everything points to a slight rise, probably not more than 10 per cent, before long. The manufacturers are paying more and more for supplies, and it is only a question of the manufacturers finding out exactly how much production costs have increased before the advance is announced. February brass, for instance, which was brought on the basis of the average price of copper for December plus a fixed amount, went up in price every few days, because the fixed amount was raised. While the brass manufacturers have been taking care of old customers, the customers have had to pay the price. It has clearly been an inconvenience to the brass mills to supply small tonnages that required considerable rolling when the munitions manufacturers were in the market for very large tonnages that required much less rolling.

Socket and plug manufacturers have had another problem to face, namely, that of scrap. In the neighborhood of 40 per cent of the brass purchased is scrapped. When the price of brass was around 18 cents it was possible to obtain 15 cents for scrap. Now that brass is 40 cents and more it is possible to obtain but 18 cents for scrap. This makes a very considerable increase in production cost. Take a purchase of say 10,000 lb. of brass. At the price new of 18 cents this would be $1,800; the scrap would bring at 15 cents $600, so that the cost of brass used would be $1,200 or at the rate of 20 cents per pound used. Now, at 40 cents new the brass would cost $4,000, the scrap would bring but $720, so that the cost of brass used would be $3,280, or at the rate of 54.7 cents per pound used.

The price of porcelain has also been advancing, and, moreover, it has been very difficult to obtain, particularly by the New England manufacturers. In this respect the railroad congestion has proved a severe handicap.

Labor has been a perplexing problem for the socket manufacturers. This has been particularly acute in regard to the supply of female operatives. In spite of the over demand, it is no uncommon sight to walk through a factory and see a machine or two idle in this row and another one in the next row, and so on, simply because it was impossible to get girls to run them.

Every effort is being made at the factories to hasten deliveries, and there is no doubt but that this condition is improving. However, with the difficulty in obtaining raw materials and operators still prevalent it is doubtful if much can be done for some time.

Collections are in good shape. Most of this class of materials is sold to jobbers and there seems to be no effort on the part of the manufacturers to limit jobbers at all. The manufacturers expecting a rising market naturally would do nothing to prevent the buying of large stocks. On the other hand, buyers are not allowed the privilege of placing a large order and stringing along the deliveries. If deliveries are specified the times must be close together, and, furthermore, the contract must be filled about as quickly as it is convenient for the manufacturers to do so. The manufacturer has been buying on delivery price and selling on contract price, and to protect himself he must demand quick acceptance of the order. Furthermore, the manufacturer is very positive on this point for another reason. He does not care to give the buyer any opportunity to purchase on long delivery dates and then cancel the order if the price drops. He is willing to protect the buyer to a certain extent but not to the extent that he himself becomes the victim.

SHORTAGE OF FEMALE LABOR

Changed Economic Condition of Laboring Classes Largely Responsible

Difficulty in securing sufficient labor has been one of the greatest of the many problems with which the manufacturer has been confronted during the past year and a half. Since the first of the year the supply of male labor has become better, but there is still a great dearth of female workers.

In the manufacture of many electrical goods there are some processes in which girls are used almost entirely. Small and nimble fingers are required. Furthermore, these processes usually require the employment of large numbers of girls. Up to the influx of war orders in 1915 there was a plentiful supply of female help for factory work, but thereafter the supply became inadequate to meet the demand.

Munition plants went into the market for female workers and did not hesitate to offer higher wages than were being paid elsewhere. This lured large numbers of girls away from other factories, including those engaged in the manufacture of electrical products. Furthermore, it has been noticed that there are actually less women working at these tasks to-day than formerly. The young men have been earning wages better by far than they formerly received, and, while living is much higher, this is not considered. As a result the girls are marrying faster. Moreover, many girls who went into the factories because the family earnings were not sufficient to keep them in school or at home, are now again taking up their studies or home duties because the wages of the father have increased sufficiently.

BUILDING MATERIALS AGAIN ADVANCE IN PRICE

Industrial New Construction Large but Weakness Shown in Speculative Development—Effect on Market for Electrical Supplies

Building materials are again advancing, and very shortly higher prices can be expected in almost every line. Construction costs, therefore, at the opening of the 1917 building season will be much more than before. There is sufficient new construction under way or contracted for to keep producers busy well into 1918, and there is consequently every reason to believe that high prices will prevail for some time.

New construction is strong in industrial buildings, but weak in speculative development. The former is a necessity. Real estate operators find little that is healthy in

speculative development at present high prices. This would include such construction as office buildings, apartment houses, hotels and dwellings for rent or sale. In industrial construction, cost is not as great a factor as is speed. One important feature in industrial construction is shipbuilding, which is going on at a tremendous rate.

For some time then it can reasonably be expected that the great demand for electrical supplies will be for industrial use. Until prices of building materials are lower the demand for electrical supplies for offices, hotels and dwellings will probably not be as large as formerly in volume, although because of higher prices the value of the sales might show no decreases.

THE SECOND-HAND MARKET OF TO-DAY AND TO-MORROW

High Cost of Buying Reduces Net Profits—Keen Competition Between Second-Hand Dealers and Motor Builders Seen as Future Possibility

While the volume of second-hand electrical machinery business is still very large, sales are beginning to ease off in most of the lines. The three-phase, 60-cycle motor is the one product for which the demand still markedly exceeds the supply. The second-hand dealer who can find one of these machines can command the highest price. A large part of all central-station energy sold for industrial work is of the three-phase, 60-cycle variety. Hence, the demand for motors of this type. In addition it is difficult to obtain new apparatus of this type quickly because manufacturers of new three-phase, 60-cycle equipment need from three to five months to build a motor of any size for this type of service, stock having been depleted months ago.

The present large volume of business in second-hand machines does not mean necessarily that large profits are being made. In the six-month period, eighteen months ago, the net profits made by wideawake second-hand dealers were high enough to cause considerable satisfaction. This condition, on account of the steadily rising prices of new apparatus, continued so that net profits up until three months ago were still felt to be ample. Within the last three months, however, there is every indication that conditions have changed considerably. Now it is reasonable to believe that the net profits are so low that the merchant is earning only a little more than a banker's rate over and above his operating expenses.

Several conditions have helped reduce the net profits. First, the delivery situation in the majority of small new-apparatus lines has become easier. Second, industrial plant owners who have a few extra motors on hand seem to be of the opinion that the motors they have should bring them prices which are approximately the list price new or better. This makes it hard for the second-hand merchant to pick up bargains. And, third, the high percentage of operating cost connected with the shops of reputable dealers has operated to cut down the net profits.

On account of these conditions second-hand merchants are not buying heavily now. They believe that the second-hand business has reached its peak and would, if peace were declared or any other similar event brought to pass, fall abruptly. These merchants believe, therefore, that it is time to take stock of their business and to guard against loading up with equipment on which they must take this loss. The state of the copper market after the declaration of peace of course will have a large bearing on the second-hand machinery market. If the price of copper is held at or near the present level by the after-the-war demand from Europe, secondhand machinery naturally will not experience so great a slump as if copper falls off rapidly. Second-hand dealers therefore are endeavoring to keep in touch with copper prices.

The price of copper, however, is only one factor in this complicated problem. When the present industrial boom is over, many manufacturing plants will have motors which were installed merely to take care of the temporary expansion in business. This equipment will be dumped on the second-hand market. The prices of much of this apparatus, in spite of the fact that it is very good machinery, will be probably not more than 10 per cent above the junk price, because the industrial plant owners undoubtedly will make every effort to rid themselves of it. Since most of it has already been written off, the present owners can better afford to take a loss on its sale than to carry it on hand.

When the industrial boom will end, of course no one can say. But even if conditions continue as they are now, for the next six months, it can be expected that second-hand merchants will buy sparingly. Indications are that they will feel their way along, attempting to take nothing but bargains. Already the practice of contracting for apparatus to be delivered in six or eight months has been discontinued. The dealer cannot see that far ahead at present, and the margin of profit in the business does not justify taking chances. Even when the munitions equipment, through the cessation of the war, begins to flood the market, the second-hand dealer will probably buy carefully. Nevertheless it is quite evident that he will buy, for he realizes that this machinery will be practically new, that it will be first-class machinery, and that if he can buy right, he will be able to offer his customers guaranteed machines at prices far below those at which the electrical manufacturers can produce them. When this condition occurs competition of the keenest kind will undoubtedly take place between the manufacturers and the second-hand merchants.

COPPER MARKET FIRM BUT QUIET

Transactions Mostly for June and July Shipments, with Some Interest in Third Quarter

The high prices of February continue for copper, but there is little buying activity, and but small amounts of metal offered. What buying there is is mostly for June and July shipments, although there is some interest being shown in third-quarter copper. Little interest is shown in March, April and May copper.

There have been some foreign inquiries for additional 1917 tonnage, but it is generally supposed that the high prices are holding up buying from abroad. There are also indications that the American Government will shortly be in the market for a large tonnage. Should the Federal Government place orders for all of the war material called for in the administration preparedness measures there would be a very great increase in the domestic demand. Production fell behind during January and February, but with warmer weather production will again be speeded up to the maximum. Shortage of freight cars has held up delivery, but warm weather will better this condition also.

The high prices for second half year delivery serve to indicate that producers, although not yet sold out, feel that productive capacity will not be sufficient to meet the demand. The feeling generally exists that higher prices can be expected before the end of 1917.

Quotations on electrolytic, on Monday, were as follows: March delivery, 36.25 cents; April delivery, 35.5 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; and fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 26 Selling Prices Bid	Feb. 26 Selling Prices Asked	Mar. 5 Selling Prices Bid	Mar. 5 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	139 0 0		139 0 0	
Prime Lake	35.00	to 36.00†	35.00	to 36.00†
Electrolytic	36.00	to 37.00†	36.00	to 36.50†
Casting	33.00	to 34.00†	33.00	to 33.50†
Copper wire base	42.50	to 43.50†	42.50	to 43.50†
Lead	8.50		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.67½	to 10.92½	10.80	to 11.05
Tin, straits	49.87½†		53.75†	
Aluminum, 98 to 99 per cent	51.00	to 53.00†	53.00	to 55.00†
OLD METALS				
Heavy copper and wire	27.50	to 28.00†	28.50	to 29.50†
Brass, heavy	17.50	to 18.00†	17.50	to 18.00†
Brass, light	13.75	to 14.00†	14.25	to 14.75†
Lead, heavy	8.00	to 8.50†	8.00	to 8.50†
Zinc, scrap	8.00	to 8.25†	7.75	to 8.00†

COPPER EXPORTS

Total tons to March 5 3,498

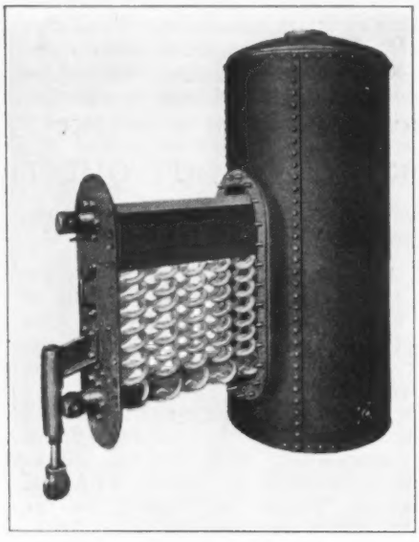
†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Submerged Type Evaporator

The Griscom-Russell Company of New York City has recently brought out a submerged-type evaporator which is fitted with a new type of coil that is said to be self-scaling. The evaporator is constructed of cast iron, steel, copper

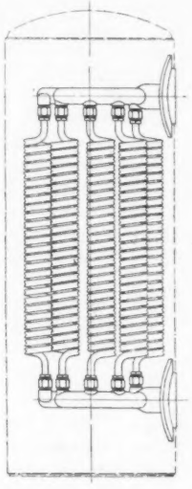


SUBMERGED TYPE EVAPORATOR WITH SINGLE MANIFOLD

or composition shell, depending upon the requirements. In all types, the arrangement of coils and internal parts is identical. The standard shells are made either of close-grained gray cast iron or open-hearth boiler and flange steel with doors and frames to correspond. Copper or composition shells are furnished specially and to specification only. The manifolds to which the coils are attached are of special composition or cast iron. The coils are of seamless drawn brass tubing, tinned or plain, rolled to shape, without filling, in order to secure a uniform thickness of metal throughout. The coil ends are equipped with quickly detachable flanged joints, free from brazing, making a metal-to-metal cone-faced bolted joint. Practically indestructible baffles are arranged so as to increase circulation and prevent priming. The manifolds are securely bolted to the door, the coils being bolted to the steam and drain manifolds, thus permitting the entire nest of coils to be removed upon opening the door. The weight of the door is taken off the hinge studs by means of a jack roller. Attached to the upper manifold is a slotted standard which guides the door when it is opened by engaging with a fixed T track firmly attached to the interior of the shell. The weight of the coils and manifolds is carried by composition rollers inside the evaporator. Zinc plates are used in steel-shell evaporators, and are conveniently arranged for replacement.

Feed-Water Heater

The feed-water heater shown in the accompanying illustration contains a group of helical coils connected in parallel between the inlet and outlet headers and in which water is heated by surrounding steam. The water to be heated does not come into contact with the steam and is therefore not contaminated with oil or other impurities suspended therein. The cylindrical shell, concave bottom and convex head are made of open-hearth boiler-plate steel, or cast-iron, as specified. The

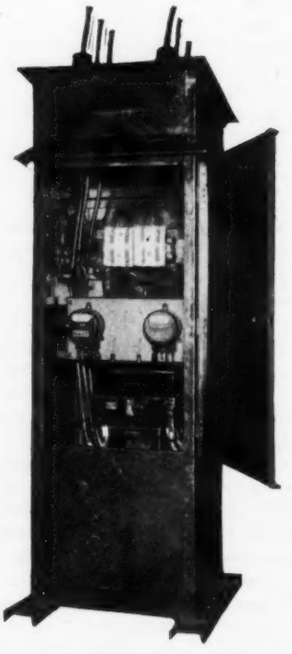


ARRANGEMENT OF COILS IN FEED-WATER HEATER

side of the shell is provided with an extra large inspection door of steel having the same radius as the shell. The manifolds, which are alike at inlet and outlet, are made of cast iron or bronze of a segmental type that permits a smooth flow, and are in contact with the shell only at the side where the connections are made. The coils are made of seamless drawn copper, are interchangeable, and have a helical form, which relieves the joints of practically all strain. Being corrugated in section, the coils present a large amount of surface for heat transfer. The helical form also permits a large amount of heating surface in a small space and yet permits free circulation of the steam. The heater is manufactured by the Whitlock Coil Pipe Company of Hartford, Conn., for Row & Davis, Engineers, Inc., 90 West Street, New York City.

Outdoor Meter-Houses

Meter-houses each containing a watt-hour meter with calibrating and testing terminals mounted on a slate base, two current transformers, and for higher voltages, two voltage transformers, are manufactured by the Westinghouse Electric Manufacturing Company of East Pittsburgh, one type of which is shown in the accompanying illustration. The standard meter-houses are constructed of steel and are designed for mounting on poles, walls, or towers. A large steel door permits ready access for reading or calibrating the meter. All internal wiring from the inlet to the outlet bushings is completed before the equipment leaves the factory, so the only wiring necessary to place the meter-house in service is to make the external connections to the power lines. Low cost and the ease with which the houses may be transported to any locality, and installed, are the chief advantages of the portable meter-house. Standard outdoor meter-houses of the type illustrated are manufactured in sizes suitable for currents up to 800 amp. and for pressures up to 7500 volts, both single-phase and polyphase, 25 and 60-cycle circuits. Equipments for high-

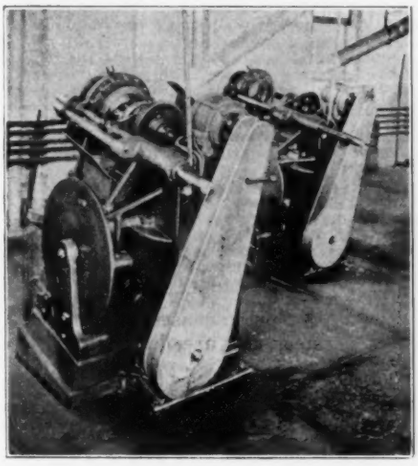


PORTABLE WEATHERPROOF METER-HOUSE FOR OUTDOOR SERVICE

tension transmission lines are often housed in a similar manner, the casing being equipped with a separate oil compartment for the transformer, choke coils, and high-tension outdoor terminals.

Self-Aligning Ball Bearing Installation

Two distinct operations are performed in two seconds by the machine shown in the accompanying illustration that is used for making paper con-

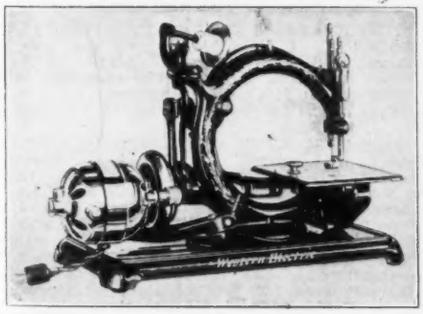


PAPER CONTAINER MACHINE WITH BALL BEARINGS

tainers. As there are continual vibrations and stresses due to wide variations in the materials fed into the machine, it is essential to use self-aligning ball bearings. The dies are made and standardized for materials 0.03 in. thick. However, it is common occurrence to pass through the machine material varying from 0.023 in. to 0.045 in., since the results are the same as with the standard thickness, due to the self-aligning ball bearings. As may be readily seen, it is essential that flexibility be obtained through these bearings. The bearings used are manufactured by the S K F Ball Bearing Company, Hartford, Conn.

Portable Sewing Machines

The Western Electric Company of New York has recently completed its line of portable sewing machines, consisting of three types—vibrator, rotary and automatic. Each type has a small

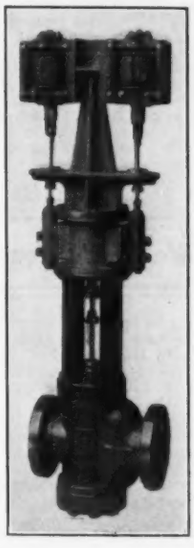


MOTOR-DRIVEN SEWING MACHINE

electric motor fastened permanently to the head. The motor will operate on either alternating or direct-current energy and has a foot control that gives any desired speed. The vibrator type makes use of the principle of the vibrating shuttle and is equipped with an automatic tension, an automatic stitch regulator and other desirable features. The rotary type differs from the vibrator in that it has a rotating bobbin, is geared higher, and runs one-third faster. The automatic type, shown herewith, is also known as the single-thread machine. It produces a chain stitch without a bobbin.

Automatic Regulator for Pulpwood Grinders

The automatic pressure regulator for pulpwood grinders shown in the accompanying illustration has been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh. Among the numerous advantages claimed for this regulator are: Prevention of peak-load charges and overload on motors; elimination of underloads, so that motors may oper-



REGULATOR THAT AUTOMATICALLY PREVENTS PEAK-LOAD CHARGES ON PULPWOOD GRINDERS

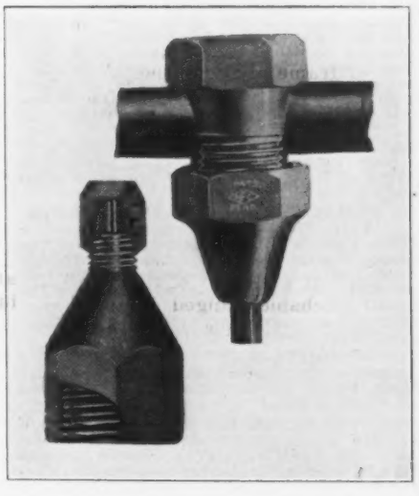
ate at practically 100 per cent load factor, and an increase in the production of groundwood with improvement in quality and uniformity of the pulp. It causes a reduction in the amount of splinters or "shives" and in the amount of short fiber carried away in the white water, is foolproof, and can be adjusted to control the grinder load only or the entire mill load. This causes a secondary relay or magnetic switch to operate, thereby energizing one of the solenoids of an hydraulic regulator valve. The core of the solenoid then raises, admitting hydraulic pressure to the upper end of the cylinder and subsequently opening the balanced regulating valve. This allows an increase in pressure in the grinder cylinders, increasing the load on the motor driving the grinders.

When the electric load has reached the point for which the primary relay is set, the primary circuit is broken, causing the secondary relay to break the secondary circuit. The core of the solenoid then drops, forcing the pilot valve piston to the lower position and preventing the admission or escape of water from the hydraulic cylinder. Consequently, the piston of the hydraulic cylinder is locked in the exact position it occupied when the pilot valve closed.

If the load should increase above the point for which the primary relay is set, the other switch of the secondary relay would close, energizing the other solenoid and opening the other pilot valve. Under these conditions pressure is applied to the lower end of the hydraulic cylinder through one of its ports and water is discharged from the upper end of the cylinder through its other port. Thus some of the pressure is applied to the grinder pockets and consequently the load on the grinder motor are reduced.

Solderless Grounding Devices

The Fargo Manufacturing Company of Poughkeepsie, N. Y., has recently developed several types of grounding devices which are shown in the accompanying illustrations. At the left is a ground device consisting of a ground point which has a standard pipe thread that may be screwed into the end of a pipe of any desired length. The cap has a solderless connection which can be easily removed for testing the ground and can be replaced after the tests have been completed. Another type of grounding device developed by this company consists of a ground point for the lower end of the pipe a cone-shaped cap and a bushing to be placed on the upper end of the pipe to support the cone. After the wire is placed in the cone, the cap is screwed to the pipe and a cold-weld connection is made which can easily be removed for testing purposes. At the right is a ground connection that is



TWO TYPES OF SOLDERLESS GROUNDING DEVICES

especially designed for making connections to water pipes in buildings as is sometimes required for electric-light and telephone service. This form of ground fits snugly around the pipe and forms a solderless cold-weld connection.

Trade Notes

FEDERAL SIGN SYSTEM (Electric) at the last meeting of the board of directors added the following to the board: Frank J. Baker, William A. Fox, John H. Gulick, Martin J. Insull and Charles A. Munroe. Samuel Insull as chairman of the board, and all of the other old directors were re-elected.

SOCKETS.—Pass & Seymour, Inc., of Solvay, N. Y., has been forced to temporarily withdraw No. 1215 pull chain candle-fixture sockets from the market.

LEWIS & ROTH COMPANY has changed its address from 311 Denckla Building, Philadelphia, Pa., to 1012 Liberty Building, Philadelphia, Pa.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., manufacturers of steam turbines and helical reduction gears, announce the opening of a district sales office in the Smith Building, Seattle, Wash., in charge of William Pullen.

HOME SPECIALTY MANUFACTURING COMPANY has changed its name to the Home Specialty Company.

THE CENTRAL CONSTRUCTION CORPORATION of Harrisburg, Pa., has acquired the business and property of the Central Construction & Supply Company. This corporation is equipped to design and construct manufacturing plants, power plants, railroad terminals and construction projects generally. The officers are: George B. Tripp, president, formerly vice-president United Gas & Electric Engineering Corporation; Joseph H. O'Brien, vice-president, formerly managing engineer Westinghouse, Church, Kerr & Co.; Charles E. Covert, secretary and treasurer, formerly treasurer of the Central Construction & Supply Company.

M. SARBINSKY, formerly city electrician and secretary of the department of public utilities of the city of Cleveland, has opened an office as consulting electrical engineer in the Citizen' Buildings, Cleveland, Ohio. Mr. Sarbinsky was recently president of the Service Electrical Company, an electrical contracting concern of Cleveland, and has since then been engaged in preparing plans and specifications for electrical installations in buildings, subways, bridges, hotels, etc. Mr. Sarbinsky would like to receive catalogs and be placed on the mailing list of manufacturers of such electrical equipment as is used in power houses, line, railway, and underground construction, in addition to that in building installations.

THE ESTERLINE COMPANY announces the appointment of James G. Biddle as district sales agent for Esterline efficiency instruments for the State of New York and the New England States, with the principal office for this territory at 90 West Street, New York City. The home office of James G. Biddle, 1211 Arch Street, Philadelphia, Pa., has for a number of years been the sales agent of the Esterline Company in eastern Pennsylvania and New Jersey, which is to be continued. This arrangement is the result of the increased business of the Esterline Company in the New York and New England territory and will result in increased facilities for handling the business in territory contingent to New York. The New York office is in charge of H. H. Sticht, resident sales engineer.

C. O. HALL, 147 West Thirty-fifth Street, New York City, New York representative of the Peerless Electric Company and the Kimble Electric Company, has recently secured the Eastern representation for the polyphase motors manufactured by the Howell Electric Motor Company and ventilating fans manufactured by the Batterman-Truitt Company of Chicago.

H. W. JOHNS-MANVILLE COMPANY'S Louisville, Ky., branch will be located after March 15 at the corner of Fourth Avenue and Guthrie Street.

B. J. GRIGSBY has associated himself with the Anderson Electric Specialty Company, 562-564 West Van Buren Street, Chicago, and will take his position as vice-president and general manager early in March. Mr. Grigsby was managing director of the Benjamin Electric, Ltd., London, England, from the date of its organization in 1908 until he resigned in December last to return to the United States.

THE ROTO COMPANY, Hartford, Conn., announces that J. D. Cherry has been appointed to the position of sales manager. Mr. Cherry is now in charge of sales of Roto tube cleaners. For a number of years he has been selling steam and fuel economy devices over a large territory in the middle West.

THE RAMEY COMPANY, Chillicothe, Ohio, is moving its plant to Columbus, Ohio, where the company has found better manufacturing conditions and shipping facilities.

Mr. C. E. INGALLS, who was formerly connected with the Crocker-Wheeler Company's Los Angeles office, and has more recently been with the company in the East, has just been transferred to the San Francisco office.

SCHWEITZER & CONRAD, Chicago, Ill., announce that they have just moved their factory from 1770 Bertean Avenue to their new building at 4431-4439 Ravenswood Avenue. The new building is one story, sawtooth construction, 100 ft. by 150 ft.

MORAN & HASTINGS TO MAKE NEW FIXTURES.—Beginning March 1, 1917, the Raymo fixtures which were formerly marketed by John D. Raymond will be manufactured exclusively and sold by the Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago. John D. Raymond will be associated with this concern in handling the Raymo products and other specialties manufactured by it.

THE WASHINGTON PIPE & FOUNDRY COMPANY, Tacoma, Wash., manufacturers of machine banded and continuous wooden stave pipe, announces the opening of an Eastern office in New York City at 3904 Woolworth Building.

WASATCH OZOKERITE COMPANY, Soldier Summit, Utah, contemplates a change in method of treatment of crude material. A new plant will be erected which is expected to handle 1000 tons of crude ozokerite per day. Ozokerite, which is used extensively in the manufacture of insulators, was formerly imported almost entirely from Austria. The war has cut off this supply and the American material is now being used. This Utah deposit is the only known commercial deposit of ozokerite in the United States and there is every reason to believe that even after the war the American product will be able safely to compete in the domestic market with the Austrian product.

Trade Publications

METERS.—Alternating-current watt-hour meters, single-phase and polyphase, are described in Bulletin No. 46 recently issued by the Sangamo Electric Company of Springfield, Ill. This bulletin supersedes Bulletin No. 40.

AMPERE-HOUR METERS.—Bulletin No. 45, descriptive of Sangamo ampere-hour meters, has been prepared by the Sangamo Electric Company of Springfield, Ill. This bulletin supersedes Bulletin No. 36.

WIRE ROPE.—John A. Roebling's Sons Company, Trenton, N. J., is distributing a bulletin on its standard wire rope.

AIR STATION.—The Black & Decker Manufacturing Company, Baltimore, Md., is distributing an illustrated leaflet descriptive of its Lectrofilater Free Air Station.

LIGHTING PLANT.—The Main Electric Manufacturing Company of Pittsburgh, Pa., is distributing a large four-page folder descriptive of its complete line of electric lighting and power plants.

VERTICAL ALTERNATORS. — "Bank Your Water Power" is the title of a carefully prepared and well-illustrated bulletin recently issued by the Electric Machinery Company of Minneapolis, Minn. This bulletin describes particularly an efficient type of installation for waterpowers of low head. The vertical alternator is direct-connected to a vertical waterwheel.

EVAPORATORS.—The Griscom-Russell Company, 90 West Street, New York City, has prepared bulletin No. 311, descriptive of its Reilly submerged type evaporator.

CONNECTORS.—The Fargo Manufacturing Company of Poughkeepsie, N. Y., has recently issued two bulletins descriptive of its solderless connectors and grounding devices.

MOTOR TRUCKS.—"Motor Trucks of America" is the title of the 1917 volume issued by the Truck Tire Department of the B. F. Goodrich Company of Akron, Ohio. This book treats the subject of lengthening the life of the motor truck. This volume will be of help to everyone interested in motor trucks.

CHEMICAL APPARATUS.—The J. P. Devine Company of Buffalo, N. Y., has recently issued miniature Bulletin No. 105, descriptive of Devine Apparatus for the Chemical and Allied Industries. This covers complete chemical, color and dyestuff plants, evaporating, concentrating and drying equipment.

New Incorporations

THE COSGROVE-COOK COMPANY, 53 Newark Street, Hoboken, N. J., has been incorporated with a capital stock of $50,000 by Charles F. Cosgrove, Edward Cook and George A. Enright. The company proposes to do a general electrical engineering and contracting business.

THE MARDELVA ELECTRIC & ENGINEERING COMPANY of Dover, Del., has been chartered by Daniel O. Hastings of Wilmington, Del.; James P. Bryan, Robert M. P. Kenton and John B. Hutton of Dover, Del.; L. LeRoy Gritzen of Baltimore, Md., and Frank C. Bancroft of Camden, Del. The company is capitalized at $150,000 and proposes to install isolated lighting plants.

THE BONNELL ELECTRIC MANUFACTURING COMPANY of New York, N. Y., has been incorporated by R. Wellman, H. F. and W. A. Bonnell. The company is capitalized at $50,000. and proposes to do a general contracting business, etc.

THE WHITESIDE MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture and deal in surgical, electrical, chemical and scientific apparatus, materials, etc. The incorporators are: O. Sampter, J. A. Anger and A. J. Sommer, 302 West 103d Street, New York, N. Y.

THE ELECTRICAL TESTING LABORATORY of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 to do a general electrical contracting business. The incorporators are: T. P. Gorman, W. Townley and J. F. Burns, Jr., 160 Flushing Avenue, Astoria, N. Y.

THE GREELEY ELECTRIC COMPANY of Brooklyn, N. Y., has been chartered by C. W. Hagen, E. E. Higbee and W. J. Killoch, 630 East Fourth Street, Brooklyn, N. Y. The company is capitalized at $5,000, and proposes to manufacture and deal in electric fixtures, telegraph, telephone supplies, etc.

THE ALLIED ENGINEERING COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 by M. Rettig, L. F. Ditthoefer and A. A. Wohlauer, 400 West 150th Street, New York, N. Y. The company proposes to manufacture and deal in electric lighting fixtures and equipment.

DANIEL R. DOUGLAS & CO. of New York, N. Y., has been incorporated by A. E. and D. R. Douglas and A. P. Sheridan, 136 Liberty Street, New York, N. Y. The company is capitalized at $15,000, and proposes to manufacture and deal in pipe, boiler covering and insulating materials.

THE MECHANICS' ELECTRIC SERVICE COMPANY of Chicago Ill. has been chartered with a capital stock of $1,000 by S. A. Rolf, G. E. Peterson and A. E. Stein.

THE TULSA (OKLA.) ELECTRIC SHOP has been incorporated by David Evans, G. E. Williams and R. L. Emler. The company is capitalized at $10,000, and proposes to manufacture electrical appliances.

THE SUPERIOR ELECTRICS of Pembroke, Ont., has been chartered with a capital stock of $100,000, to manufacture electrical machinery, etc. The incorporators are: John H. Reeves, Leonard S. Mackie, James R. Lockhart and others.

THE WILLIAM SLATER ELECTRICAL COMPANY of Memphis, Tenn., has been incorporated by W. Slater, Y. Slater, K. S. Cooper and J. L. McRee. The company is capitalized at $10,000, and proposes to do a general electrical business, steam heating, etc.

THE T. F. KEEGAN ELECTRIC COMPANY of Lewiston, Me., has been incorporated with a capital stock of $10,000 to do a general manufacturing business. The officers are T. F. Keegan, president and treasurer, and W. H. Clifford, clerk, both of Lewiston.

THE PEERLESS LIGHT COMPANY of Portland, Me., has been incorporated by Albert F. Jones, T. L. Croteau, P. B. Drew, A. B. Farnham and George S. Soule of Portland, Me. The company is capitalized at $500,000 and proposes to manufacture and deal in gas and electric lamps, fixtures, devices, equipment, etc.

STINSON & GOULD, INC., of Buffalo, N. Y., have filed articles of incorporation with a capital stock of $10,000, to manufacture storage batteries, electric machinery and auto equipment. The incorporators are: R. H. Templeton, C. F. Gould and J. E. Stinson, 27 Dorchester Road, Buffalo, N. Y.

New England

AUGUSTA, ME.—The Central Maine Power Company has petitioned the State Legislature for authority to purchase plants, franchises, etc., subject to the approval of the Public Service Commission, of Bath & Brunswick Light & Power Company, the Penobscot Bay Electric Company, the Waldoboro Water & Electric Light & Power Company, the Hartland Electric Light & Power Company, the Union Light & Power Company, the Newport Light & Power Company and the Wicasset Electric Light Company.

RAYMOND, N. H.—The Raymond Electric Company has purchased a water power site about 1 mile distant from the present steam plant, and contemplates the construction of a concrete dam and power house. The initial installation will include a 200-hp. water wheel and generator. C. F. Gardner is manager.

GRANBY, VT.—The property of the Granby Municipal Lighting Company is reported to have been purchased by Charles H. Thompson of Montpelier and associates, who have formed a company to be known as the Vermont & Quebec Power Company. Preparations are being made to connect the Granby plant with the one controlled by the same parties at Richford, Vt.

BOSTON, MASS.—Among the improvements contemplated by the Edison Electric Illuminating Company of Boston are included the erection and equipment of two substations and the installation of two 30,000-kw. generators in the main power station at L Street.

CHICOPEE, MASS.—The Board of Electric Light Commissioners contemplates the erection of new 3750-kva., outdoor substation to connect with the transmission line of the Turner Falls Power & Electric Company. Some changes are being made to the street-lighting system.

FALL RIVER, MASS.—Plans are being considered by the Fall River Electric Company for extensions to its plant this summer, which will include the installation of a 6250-kw., General Electric turbo-generator. During the year a 66,000-volt, double-circuit, steel-tower transmission line will be erected connecting the steam plant of the company with the transmission lines of the New England Power Company at East Providence, R. I. A substation will be erected on the Taunton River, which will be equipped with three 5000-kva. transformers. The company is also considering an extension of its lines to Dighton, 10 miles distant.

WEBSTER, MASS.—The installation of an ornamental lighting system in the business district is under consideration. The street-lighting service is supplied by the Webster & Southbridge Gas & Electric Company of Webster. H. S. Shaw is manager of the company.

Middle Atlantic

AUBURN, N. Y.—The Empire Gas & Electric Company is planning to install a 2000-kva. synchronous condenser at its power station in Auburn and also at its plant in Geneva. Ten three-phase automatic-feeder regulators will be installed in the substation and a water power will be developed (about 500 kw.) on the Canandaigua Outlet at Lyons. L. C. Reynolds is general superintendent.

BROOKLYN N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 14, for furnishing and installing one 8-section, 80-cell storage battery for engine house No. 217, borough of Brooklyn. Blank forms and further information may be obtained at the above office.

DUNDEE, N. Y.—Edward L. Bailey, owner of the local electric-light plant, is gradually extending the electrical service throughout the township of Starkey Township, reaching the small communities and summer colonies at Seneca Lake and intermediate farms and vineyards. The purchase of energy from the Elmira Water, Light & Railroad Company or the Taylor Chemical Company, which has a large hydroelectric development on the Keuka River, between Penn Yan and Seneca Lake, about 10 miles distant, is under consideration.

FORT ANN, N. Y.—Bids will be received by the Board of Trustees of Fort Ann, until March 15 for construction of water works system, including mechanical gravity plant, pumping station and equipment, and 250 tons of 6-in. and 8-in cast-iron pipe. Charles E. Perry, 36 State Street, Albany, N. Y., is consulting engineer.

FRANKLIN, N. Y.—The Delaware & Otsego Light & Power Company is contemplating the erection of an electric transmission line to Meridale, through the village of Treadwell, a distance of about 14 miles, and it may also build a line to Sidney Center, a distance of 5 miles. H. D. Mackey is manager.

MECHANICSVILLE, N. Y.—The capital stock of the Halfmoon Light, Heat & Power company has been increased from $75,000 to $150,000, the proceeds to be used for expansion to business.

NEW YORK, N. Y.—The Sixth Avenue Association is considering the feasibility of using the elevated railroad structure for street-lighting purposes.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 14, for furnishing 1500 terminal boxes for fire alarm posts. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 16, for furnishing three portable insulation testing outfits. Blanks, forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Application has been made to the Public Service Commission by the Interborough Rapid Transit Company, 165 Broadway, for permission to issue $16,436,000 in bonds, the proceeds to be used as follows: For alterations in power plants, $2,391,000; extensions and equipment, $2,533,000, and for third-track installation and equipment, $10,444,000.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York, N. Y., until March 13, for furnishing and installing subsidiary pipes and installing fire alarm posts from Eighty-second Street to Fort George Avenue, in the borough of Manhattan. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the Department of Charities, tenth floor, Municipal Building, New York City, until March 21 for furnishing material and installing fire signal systems in the various groups of buildings under the jurisdiction of the Department of Charities. Blank forms and further information may be obtained at the office of Porter & Himmelwright, engineers, Fifth Avenue Building, New York City, where plans and specifications may be seen. John A. Kingsbury is commissioner.

ROCHESTER, N. Y.—Tentative plans are being prepared by the Buffalo, Rochester & Pittsburgh Railway Company of Rochester with a view of constructing a power house, machine shop, blacksmith shop, storehouse, coaling station and additions to roundhouse, which if carried out will involve an expenditure of about $200,000.

TOMPKINSVILLE, N. Y.—The electric plant of the Tompkinsville Electric Light & Ice Company was recently destroyed by fire, causing a loss of about $8,000. Arrangements are being made for temporary service and also for rebuilding the plant.

ALLENTOWN, PA.—Extensive improvements are being made to the transmission system and distributing lines of the Lehigh Valley Transit Company over the entire system from Philadelphia to Slatington. About $110,000 has been expended and the cost of the proposed work is estimated at about $200,000.

HAZLETON, PA.—The Harwood Electric Company is contemplating installing an electric lighting system in Conyngham near Hazleton.

HAZLETON, PA.—The Harwood Electric Company is negotiating with different municipalities in this vicinity for the installation of electric distributing system. The company proposes to supply electrical service to all towns and cities within a radius of 25 miles.

HEREFORD, PA.—A company is being organized by A. E. Ward and W. H. Schubert to supply electrical service in Hereford and Washington Townships.

LANCASTER, PA.—The Edison Electric Company is contemplating extending its transmission lines from a point near Lititz to Mount Hope.

MARCUS HOOK, PA.—The Congoleum Company is considering the erection of a new boiler plant, 50 ft. by 82 ft., at its linoleum factory, to cost about $10,000.

MILLERSTOWN, PA.—The Perry Electric Light, Heat & Power Company of Newport is contemplating the installation of a street-lighting system in Millerstown.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company has awarded a contract to F. A. Havens & Company, 845 North Nineteenth Street, Philadelphia, for the erection of a power house, 40 ft. by 120 ft., at its local yards.

PHILADELPHIA, PA.—Bids are being received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a one and one-half story machine and electric shop, 150 ft. by 500 ft., at the navy yard, Philadelphia, to cost about $500,000.

PHILADELPHIA, PA.—The cost of the proposed subways and elevated lines is placed at $90,000,000, with additional $14,000,000 for necessary operating equipment. The present appropriation of $63,000,000 is to be used for construction of subways, delivery loops and work on Frankford elevated road. W. S. Twining, 754 Bourse Building, is director of transit department.

HILADELPHIA, PA.—Bids will be received by the Director of Department of Public Works and the Board of Trustees of the Free Library of Philadelphia, Room 201, City Hall, Philadelphia, until March 27, for erection of the building for the Free Library of Philadelphia. Bids will be received for this work under four separate proposals as follows: (1) For the entire work, excepting plumbing, heating and ventilating work and the electrical work; (2) plumbing work; (3) heating and ventilating work; (4) electrical work. Plans and specifications may be secured upon application to Horace Trumbauer, architect, 1406 Lankd Ttitle Building, Philadelphia. The amount available for construction of this building is $3,050,000.

POCOPSON, PA.—Application has been made to the Governor of the State of Pennsylvania by C. R. Maguire, J. C. Murtagh and Herman H. Wilson for a charter for the Pocopson Township Electric Company for the purpose of supplying electricity for lamps, heaters and motors in the township of Pocopson. Townsend, Elliott & Munson, 715 Walnut Street, Philadelphia, are solicitors.

POTTSVILLE, PA.—The Philadelphia & Reading Railway Company, it is reported, is planning to equip its system from Pottsville to Schuylkill Haven, and thence to Reading, a distance of 37 miles, for electrical operation. The cost is estimated at $750,000.

READING, PA.—The Reading Engineering works is reported to be in the market for a 70 to 100-kw., three-phase, 60-cycle generating unit, consisting of a generator and steam engine.

SELLERSVILLE, PA.—The engine house of the Rock Hill Industrial Company, near Sellersville, was recently destroyed by fire.

TILSONBURG, PA.—Plans are being considered by the Canadian Cereal Company for equipping its mills throughout for electrical operation.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company is planning to extend its transmission lines to furnish electrical service in the Buena Vista Springs district.

WILKES-BARRE, PA.—The Public Service Commission has given its approval of the franchise granted to the Wilkes-Barre Light Company; also of the five-year contract for street-lighting recently awarded the company.

YEADON, PA.—The Theodore Presser Company of Philadelphia is contemplating the erection of a power station, 70 ft. by 70 ft., at its local printing plant.

ELMER, N. J.—The American Railways Company of Wilmington, Del., a subsidiary of the National Properties Company, is planning to install an electric-lighting system in Elmer.

GIBBSTOWN, N. J.—The Borough Council is considering the installation of a street-lighting system between Gibbstown and Paulsboro. A proposition to acquire the local street-lighting system is also under consideration.

IRVINGTON, N. J.—The Town Commission is considering awarding a contract to the Public Service Electric Company for street-lighting for a period of five years. An appropriation of $14,000 has been made for street-lighting.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until March 13 for the installation of boilers and equipment at Overbrook Hospital, Cedar Grove. Plans and specifications are on file in the office of Runyon & Carey, consulting engineers, 845 Broad Street, Newark.

TRENTON, N. J.—To provide for the installation of the proposed ornamental street lighting system in the business section, a bill has been introduced in the legislature authorizing assessments of abutting

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

property holders profiting by the improvement.

NEW CASTLE, DEL.—The plant of the Delaware Water Improvement Company, including engine house, pump room and electric transformer station, was recently destroyed by fire, causing a loss of about $20,000.

BLUEFIELD, W. VA.—The Appalachian Power Company is contemplating extensions to its transmission lines during the coming year, but as yet definite plans have not been decided upon. At the present time an 88,000-volt transmission line, 26 miles long, is under construction. The company has decided to erect 20 miles of 13,000-volt transmission line at once.

KENOVA, W. VA.—The installation of a 10,000-hp. turbine with condensers in the local plant is under consideration by the Consolidated Light, Heat & Power Company. The company is now erecting a high-tension transmission line from Kenova to Ironton, 12 miles long, and is also considering the installation of a pumping plant at the Big Sandy River.

WHEELING, W. VA.—The Wheeling Electric Company is planning to erect a 66,000-volt transmission line from Wheeling to Windsor, a distance of 12 miles, some time this year. A 66,000-volt transmission line from Wheeling to Moundsville, 10 miles long, is now being erected by the company.

WHEELING, W. VA.—The Sunnyside Electric Company is contemplating the extension of its 66,000-volt transmission line from Dillonvale, Ohio, to Amsterdam, Ohio, a distance of 25 miles, and from Fairport to Flushing, Ohio, 9 miles. The company will probably erect several short extensions of from 1 to 4 miles in length to furnish energy to the coal mines in the district it serves.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of the Post Office Department, Washington, D. C., until March 28 for furnishing electrical supplies, including motors, carbons and fuses, duplicating devices, rubber goods, computing, mailing, addressing, opening, adding (check writing) and perforating machines, time recorders, etc., as they may be ordered for use for the postal service during the fiscal year beginning July 1, 1917, and ending June 30, 1918. Blanks for proposal, with specifications and instructions to bidders, will be furnished upon application to the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 21 for furnishing and installing lighting fixtures in the United States Post Office at Aberdeen, Wash.; Alliance, Ohio; Belton, Tex.; Douglas, Ariz.; Grinnell, Iowa; Little Falls, Minn.; Maryville, Tenn.; Minden, La.; Neenah, Wis.; Redfield, S. D., and St. Petersburg, Fla.; also at the United States Post Office, Custom House and Courthouse at Corpus Christi, Tex., in accordance with plans and specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 786—166,000 ft. of telephone cord, 520,000 ft. bell wire, 47,000 ft. twin-conductor wire; Schedule 784—125,000 ft. rubber-covered single wire; Schedule 794—462 brass lamp feeders. Mare Island, Cal., Schedule 802—264 brass grease cups; Schedule 802—90 Klinger type gauge glasses. Philadelphia, Pa., Schedule 786—9300 plug fuses; Schedule 784—200 seamless steel boiler tubes. Newport, R. I., Schedule 778—150 air pressure gages, 120,000 ft. fiber rod tubing. Mare Island, Cal., and Brooklyn, N. Y., Schedule 776—miscellaneous steam sirens, whistles, etc. Brooklyn, N. Y., Philadelphia, Pa., Schedule 787—5300 steel wire casting brushes. Puget Sound, Wash., Schedule 802—90 electric soldering irons. Applications for proposal blanks should designate the schedule desired by number.

North Central

BALDWIN, MICH.—Grand Rapids and Muskegon capitalists, it is reported, are interested in a proposition to develop a water power on the Pere Marquette River, near Baldwin. Options have been secured on 16 miles of river lands above the site, as well as the purchase of 2 miles outright, it is said, have been secured by V. W. Montgomery of Reed City.

BENTON HARBOR, MICH.—The Superior Steel Casting Company is planning to build an extension to foundry, 140 ft. by 142 ft., and expects to purchase a 10-ton electric traveling crane, two 250-hp. motors, an electric furnace and an air compressor. The company, it is stated, will build in the near future a two-story pattern and office building, 50 ft. by 100 ft., and also erect a unit power house.

BURR OAK, MICH.—Franchises have been granted to the United Electric Company of Burr Oak to erect transmission lines through several townships in Calhoun and Branch Counties. The company is also seeking franchises to supply electricity in Athens, Tekonsha and other villages.

HOLLY, MICH.—Plans are being considered by the Consumers Power Company of Flint to supply electricity in Holly under a franchise granted to the Independent Power Company four years ago. The company, it is understood, has an option on the Holly plant and equipment.

LOWELL, MICH.—Bonds to the amount of $40,000 have been voted for rebuilding the municipal electric-light plant.

PETOSKEY, MICH.—Extensive improvements are contemplated to the municipal electric light and power plant. The upper dam is to be discontinued and the water flumed to the lower dams, where two water wheels will be installed.

SPRINGPORT, MICH.—The installation of a new 40-kw., direct-current generator this year for the municipal electric light plant is under consideration. L. E. Landan is manager.

DAYTON, OHIO.—Plans are being prepared for construction of a plant for the Dayton Rubber Manufacturing Company. The main building will be 150 ft. by 500 ft., one story. The power plant will be in a separate building.

HICKSVILLE, OHIO.—The local system of the North Western Ohio Light Company has been rebuilt for alternating current, energy to be obtained from the main station of the company at Delphos. The local (old) station will be remodeled and used as an auxiliary plant. P. W. French is local manager.

MILFORD, OHIO.—The City Council is considering the installation of a new street-lighting system in connection with the granting of a new franchise which expires in April. The street-lighting service is furnished by the Cincinnati, Milford & Loveland Traction Company. Charles C. Harris of Cincinnati is general manager.

QUINCY, OHIO.—Bonds to the amount of $4,500 have been voted for the installation of a municipal electric lighting system. Energy for operating the system will be supplied by the Allinger Milling Company.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has decided to install underground cables at a cost of about $20,000. Other improvements contemplated by the company include extensions to the boiler room of the power station, the erection of a high-tension substation and the installation of a 3000-kva. transformer.

INDIAN BOTTOM, KY.—Preparations are being made to establish a light and power plant at the Stuart-Robinson College at Blackey, Ky., work on which will start within 30 days. For further information address Rev. H. V. Tedlock, principal, Indian Bottom.

WHITESBURG, KY.—Arrangements are being made by W. W. Gibson & Son of Mayking for the construction of an electric-light and power plant in Whitesburg.

CONVERSE, IND.—The property of the Converse Light & Power Company has been purchased by the Indiana Railways & Lighting Company of Kokomo. The Indiana company was also authorized to issue $140,000 in capital stock.

INDIANAPOLIS, IND.—Work has been started by the Indianapolis Light & Heat Company on the construction of its new power plant to be located at Kentucky Avenue and South Street. The portion of the plant to be completed this year will provide space for the installation of ten 1000-hp. boilers, two 20,000-kw. horizontal turbines, with surface condensers and other auxiliary apparatus. A 15,000-ton underwater storage pit for coal will be built in connection with the plant. While the work has been started, all contracts have not yet been awarded.

RICHMOND, IND.—Improvements have been authorized by the Board of Public Works to the municipal electric light and power plant, involving an expenditure of about $50,000. Two 500-hp. boilers will be installed.

CHICAGO, ILL.—Improvements contemplated by the Commonwealth Edison Company during the coming year will include the installation of two additional units in the Northwest station, one 30,000-kw., 60-cycle, 12,000-volt turbo-generator, the other a 35,000-kw., 25-cycle, 9000-volt turbo-generator. The company is installing at its substation a total of 10,000 kw. in 250-volt synchronous converters for the direct-current district, and a total of 30,000 kw. in 60-cycle transformers for other substations, and 18,000 kw. in synchronous converters in railway substations.

PEORIA, ILL.—The capital stock of the Central Illinois Light Company has increased its capital stock from $5,500,000 to $20,000,000, the proceeds to be used for extensions to plants and for the purchase of additional equipment.

ROBERTS, ILL.—The citizens have voted to enlarge the municipal electric-light plant.

ROCKFORD, ILL.—The Rockford Electric Company is contemplating extensive improvements to its plant, which will include the installation of a 12,500-kva. Curtis turbine, two 750-hp. boilers. The construction of a 15,000-ton coal storage pit, at a cost of $75,000, is also under consideration. Extensions and other work on its distribution system, involving an expenditure of about $98,000, is also contemplated by the company.

JUDA, WIS.—Preparations, it is reported, are being made by Charles Schwartzlow for the erection of a power plant to supply electricity in Juda.

NESHKORO, WIS.—The property of the Neshkora Light & Power Company has been purchased by the Wisconsin Power, Light & Heat Company of Milwaukee.

SEYMOUR, WIS.—The local electric light plant, owned by S. D. Newell, has been purchased by W. E. Daniels of Worthington, Ind.

WATERTOWN, WIS.—Extensions and improvements are being made to the local plant of the Wisconsin Gas & Electric Company, including the installation of a 2000-hp. motor-generator set with switchboard and other necessary substation equipment.

WAUPACA, WIS.—The property of the Waupaca Electric Light & Railway Company has been purchased by E. A. Aspnes of Montevideo, Minn., and Truman Hibbard of Minneapolis, Minn. The new owners, it is reported, contemplate improvements to the plant and system.

DETROIT, MINN.—Bids will be received by the City Council, City Hall, Detroit, Minn., until March 19 for furnishing and installing one switchboard complete. Plans and specifications may be obtained upon application to the Charles L. Pillsbury Company, engineers, Metropolitan Building, Minneapolis.

FOLEY, MINN.—The Public Service Company of St. Cloud, it is expected, will extend its high-tension transmission line from St. Cloud to Foley in the near future to supply energy to the local company. A. J. Hakes is superintendent.

PARKER'S PRAIRIE, MINN.—The Morrison Electric Company contemplates installing a 45 or 60-hp. engine to replace the 30-hp. engine now in use. If an electric transmission line is erected from Fergus Falls or Little Falls into Parker's Prairie, the company will change its system from direct to alternating current and secure service from the high-tension transmission system. L. J. Morrison is manager.

ROCHESTER, MINN.—Plans, it is reported, have been submitted by Hugh L. Cooper, consulting engineer, 101 Park Avenue, New York, N. Y., to the City Council, for the construction of a hydroelectric plant on the Zumbro River. The cost is estimated at about $600,000.

DEXTER, IOWA.—At an election to be held March 13 the proposal to grant a franchise to the Iowa Electric Company of Marengo will be submitted to the voters.

KANSAS CITY, MO.—The Southwestern Bell Telephone Company has appropriated $4,500,000 for extensions and improvements to its system in the states of Missouri, Arkansas and Texas. Details as yet have not been decided upon, but will include additions, reconstruction and new construction work in various exchanges and toll lines, etc. B. S. Read, 314 North Broadway, St. Louis, Mo., is second vice-president of the company.

MARYVILLE, MO.—The Maryville Electric Light & Power Company will erect an electric three-phase, 22,000 volt transmission line to Barnard, a distance of 15 miles, in the spring, and will also install a 300 to 350-kva. generator directly connected to a Corliss engine. The company may purchase a second-hand unit. Charles C. Hellmers is manager.

ST. LOUIS, MO.—Clyde B. Judd, Wainwright Building, St. Louis, is reported to be in the market for power plant equipment and excelsior making machinery.

ST. LOUIS, MO.—Extensive improvements will be made to the electric plant of the Laclede Gas Light Company during the coming year, which will include the removal of one 1000-kw. generating unit and the installation of a 4000-kw. General Electric generating unit with condensing equipment, increasing the output from 8000 to 12,000 kw. George B. Evans is chief engineer.

HEBRON, N. D.—The Hebron Electric Light & Power Company will make several short extensions to its transmission lines to connect about 20 to 25 additional consumers in outlying districts, material for which has been purchased.

CANBY, S. D.—The Citizens' Light, Heat & Power Company has secured franchises in Clear Lake, S. D., and Hendricks, Minn. Transmission lines will be erected to these places in the spring. Emil W. Erick is general manager.

DELL RAPIDS, S. D.—Plans are being prepared by the Electric Development Company, engineer, Omaha, Neb., for the construction of a municipal electric-light and power plant, to cost about $35,000.

IROQUOIS, S. D.—Improvements are contemplated by W. L. Jordan, owner of the local electric-light plant, including the installation of a new gas engine and generator (about 25 kva.), to pull the day load. Work will probably begin this summer.

PLANKINTON, S. D.—The purchase of the local electric-light plant, owned by F. Marso, it is understood, is under consideration by the City Council.

IMPERIAL, NEB.—Bids will be received by city of Imperial until March 14 for the construction of an electric-light plant. The work will include power house, reconstruction of dam, water wheel, vertical shaft generator, switchboard, 5 miles of transmission line, distributing system and series street-lighting system. The cost of the plant is estimated at $17,300. Grant & Fulton, Bankers Life Building, Lincoln, are engineers.

PLAINVIEW, NEB.—Improvements are contemplated to the municipal electric light, water and power plant, including the installation of an additional 150-hp. boiler, a 150-hp. generating unit (directly connected), a central heating plant in connection with lighting plant, a water supply tank for city water, and probably addition to power house, etc.

CHANUTE, KAN.—Arrangements have been completed by the Kansas Gas & Electric Company for the construction of an electric power plant on the Santa Fe River to cost about $1,000,000. The proposed plant will have an output of 10,000 kw. and will be used as a main generating station for the company's properties in this section. The smaller plants will be used as auxiliaries.

EUDORA, KAN.—Bids will be received by the Board of Commissioners of the First Water and Sewer Districts of Eudora, Ark., until March 21 for construction of a complete water works and sewer system, including oil engines, pumps, steel tower and tank, gates, water pipe, pump house and reservoir. Specifications, etc., may be obtained upon application to Xavier A. Kramer, consulting engineer, Magnolia, Miss.

LAWRENCE, KAN.—Bids will be received by F. D. Brooks, city clerk, Lawrence, Kan., until March 21 for improvements to water works system, including one 3,000,000-gal crank and fly wheel Corliss pumping engine, one 1,000,000-gal. Myer gear crank and fly-wheel pumping engine, boiler and boiler room equipment, one 150-hp. return tubular boiler and equipment for a 3,000,000-gal. rapid sand filter plant. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

McPHERSON, KAN.—Plans are being prepared by Black & Veatch, engineers, Interstate Building, Kansas City, Mo., for improvements to the municipal electric-light plant, including the installation of a 250-hp. water tube boiler, a 300-kva. steam driven generating unit (directly connected), feed water heater, boiler feed pumps, necessary high pressure piping, etc.; a brick or concrete chimney, 54 in. in diameter and 90 ft. high, will be erected and necessary changes made to the present power house to provide space for the new equipment. Arthur Groesbeck is superintendent.

NEWTON, KAN.—The City Council is considering the installation of a municipal electric light plant.

WAVERLY, KAN.—Plans are being considered for improvements to the municipal electric light plant.

Southern States

CHARLOTTE, N. C.—Contracts have been awarded by the Southern Power Company for the construction of a hydroelectric plant at Watersee, S. C., to cost about $5,000,000. The new plant will be located 6 miles above Camden, and will connect with the other six plants of the company. The proposed plant will be completed by Nov. 1, 1918, and will have an ultimate capacity of 100,000 hp.

ROCKY MOUNT, N. C.—Extensive improvements are under way at the municipal electric-light plant, including the installation of two N. Y. Continental Jewell filters, two Worthington volute motor-driven pumps of 1500 gal. per minute capacity, all pipe connections for above apparatus and enlarging power house. Further improvements contemplated include the installation of an additional boiler, constructing intake for water supply and condensers and erecting two more circuits from power plant to city. A. S. Lyon is manager.

FOUNTAIN INN, S. C.—The City Council is considering calling an election to submit to the voters a proposal to issue $50,000 in bonds for the construction of electric-light plant, water-works and sewer system.

COPPERHILL, TENN.—The Home Light & Power Company has entered into a contract with the Tennessee Power Company for energy to operate its system, which will take effect as soon as a substation can be equipped. The company will discontinue its local plant and extend its transmission line to cover what is known as the Ducktown Copper Basin, which embraces a territory of 5 miles in diameter and a population of about 15,000. M. C. King is president.

MILLINGTON, TENN.—The electric system of the Millington Light & Water Works will be changed from direct to alternating current this spring and the electrical service extended to take in two small nearby towns. Meters will also be installed for more than a two-light circuit. W. C. Hill is manager.

SOMERVILLE, TENN.—Extensions and improvements to the municipal electric-light plant and water-works system is under consideration by the City Council.

GULFPORT, MISS.—Bids will be received at the office of John T. Connell, director of works, Gulfport, until March 27 for furnishing material and installing electrical system on the grounds and in buildings of the Mississippi Centennial Exposition. For details see proposal columns.

FORT RENO, OKLA.—The War Department has announced that funds are available for the installation of an electric plant at Fort Reno.

MAYSVILLE, OKLA.—The installation of an electric-lighting system in Maysville is under consideration.

SNYDER, OKLA.—The city of Snyder is contemplating extending an electric transmission line to Mountain Park, 2½ miles distant, in the near future. The line will consist of two wires and transmit energy at 2300 volts, 60 cycles. T. H. Kennedy is superintendent.

GOLIAD, TEX.—The Goliad Supply Company expects to erect a new engine room, 45 ft. by 50 ft., and install a 100-kw. generator and a 125-hp. oil engine before fall. Edward F. Glaze is president and manager.

HUBBARD CITY, TEX.—The Union Central Light & Power Company is in the market for second-hand transformers (in first class condition), marble or stone switchboards for 2300-volt, 60-cycle, three-phase electrical apparatus. W. A. Bass is president.

PILOT POINT, TEXAS.—The Pilot Point Ice & Power Company is considering the installation of new dynamos and establishing a day circuit soon.

Pacific States

CHEWELAH, WASH.—The City Council has signed a contract with the Stevens County Power & Light Company for electricity to operate the local system. The local plant will be discarded as soon as transformers are installed.

SULTAN, WASH.—Two notices of appropriation of water (1500 ft. of water per second each) from the Sultan River in the Sultan Basin have recently been filed with the county auditor. Dams, flumes, tunnels, etc., will be used for the diversion of the water. G. D. Hite of Sultan is interested.

VALLEY, WASH.—J. G. Kulzer, owner of the local electric system, will extend his transmission lines to a farming community, a distance of 4 miles. New equipment, including 2-kw. transformers and some 5-kw. transformers, all 6600/110 volts, 60 cycles, will be required.

WENATCHEE, WASH.—The water power site known as the Purple property was recently purchased by the Chelan Electric Company, a subsidiary of the Great Northern Railway Company, for $135,000. The property will be used in connection with the electric development of the Great Northern Railway development on Lake Chelan.

BURNS, ORE.—The Electric Light & Power Company has just completed a transmission line to the plant of the Burns Flour Milling Company and has installed a 75-kw. General Electric generator. The company has also entered into a contract with the Burns company for its surplus power and will purchase a 35-in. Samson turbine and develop about 100 hp. additional, which will enable the Electric Company to extend its transmission lines to two or three outlying districts. Roy C. Dwyer is secretary and manager.

CONDON, ORE.—The Condon Electric Company contemplates the installation of a 75-hp. oil engine in June to replace the 50-hp. engine now in use. A. B. Bower is secretary and manager.

FRESNO, CAL.—The proposal to issue $4,500,000 in bonds of which $1,000,000 will be issued immediately, will soon be submitted to the stockholders of the San Joaquin Light & Power Corporation. The proceeds of the first million dollars will be used entirely for additions and betterments to present plants of the company and for the purchase of new property.

BAKER, MONT.—The Baker Light & Power Company will install in August a 125-hp. boiler and one three-phase direct-connected unit. Ernest G. Heinrich is owner and manager.

GLASGOW, MONT.—The city of Glasgow contemplates the installation of a 500-hp. Diesel engine in the municipal electric-light plant. C. H. Blitman is manager.

MILES CITY, MONT.—The annual report of J. J. McGill, superintendent of the municipal electric-light plant, recommends improvements to the municipal electric-light plant, including the installation of a new 1000-hp. heater, new stokers for at least three of the five old boilers, the purchase of a new generator for direct connection to the 375-hp. Corliss engine now in use, raising roof of boiler house and remodeling coal conveyor.

ROCK SPRINGS, WYO.—The Union Pacific Coal Company contemplates extending its transmission lines from Rock Springs to Superior within a year to supply electrical service. It also proposes to install one more battery of boilers and a 3500-kw. alternator and the erection of a 33,000-volt, three-phase transmission line to Superior, a distance of 20 miles. B. L. Betcher of Rock Springs is local manager.

CARLSBAD, N. M.—Plans are being prepared by the Public Utilities Company for the installation of a new auxiliary steam or oil driven plant of 150 kw. capacity, to be used in case of emergencies or high water. E. A. Roberts is manager.

Canada

EDMONTON, ALTA.—Plans are being prepared by W. H. Gibson, 11,432 Seventy-ninth Street, Edmonton, for the construction of a lumber mill, to cost about $18,000. Two boilers of 100 and 150 hp., two engines, two high-speed planers, and equipment for an electric-light plant, etc., will be purchased.

WINNIPEG, MAN.—Plans are being considered by the City Council for increasing the output of the Point du Bois power plant to 100,000 hp. The cost is estimated at $150,000.

ST. JOHN, N. B.—The property of the St. John Railway Company, which includes the street railway system, electric-lighting and power and gas plants, has been sold to the New Brunswick Investment Company for $1,300,000. The purchasing company is a holding company for the New Brunswick Power Company and is interested in the development of water power sites near St. John.

CHIGNECTO, N. S.—The Maritime Coal, Railway & Power Company contemplates the purchase of electrically operated pumps, motors, etc., for its plant. R. J. Bell is manager.

MEADFORD, ONT.—The Georgian Bay Milling & Power Company is considering the installation of water wheels of 250 hp. capacity. W. J. Moore is manager.

ST. MARYS, ONT.—The Water and Light Commission is changing the primary voltage of all transformers on lines to 4000 volts grounded star; station transformers connected delta primary and star secondary, using one side of 110 volt secondary as a ground wire, where secondary does not extend; also installing three 50-kva. transformers for 250-hp. condenser and one 100-hp. motor for pump; one 25-hp. motor-driven centrifugal pump and automatic switch, and one 135-hp., six cylinder, high-speed gasoline engine directly connected to multi-stage centrifugal pump, electric and air starter, and also a motor-driven fire whistle. H. M. Miller is superintendent.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until March 15 for furnishing under proposal 2108, 72 self-lubricating blocks, cable clips, six electric heaters, one rod bender, 100 lb. copper wire, etc. Further information may be obtained at the above office.

1,217,135. FASTENING-CLIP FOR WIRE-TERMINALS; Charles W. Beck, Detroit, Mich. App. filed Aug. 12, 1912. Improved device.

1,217,148. X-RAY APPARATUS; Eugene W. Caldwell, New York, N. Y. App. filed July 15, 1911. May comprise polyphase high-potential transformers which may have their primaries simultaneously connected to a polyphase supply circuit by an operating switch.

1,217,149. X-RAY APPARATUS; Eugene W. Caldwell, New York, N. Y.. App. filed May 18, 1914. X-Ray tube may be arranged in series with a suitable current equalizing inductance.

1,217,175. BURGLAR-ALARM; Albert O. Hilley, Waco, Tex. App. filed Oct. 15, 1915. New and useful improvements.

1,217,180. DOOR-CONTROLLING AND SIGNALING SYSTEM; Marcus M. Huebsch, Chicago, Ill. App. filed June 13, 1914. From a remote point.

1,217,187. SYNCHRONOUS MOTOR; Austin Kimble, Chicago, and John D. Nies, St. Charles, Ill. App. filed Jan. 2, 1914. Single-phase or polyphase type which are self-starting by means of alternating current.

1,217,226. ELECTRICALLY-HEATED EMBOSSING-BASE; John H. Schussler, Chicago, Ill. App. filed Feb. 15, 1915. Provide means whereby an improved grade of embossing may be done in an ordinary printing press.

1,217,244. AUTOMATIC STARTER AND LIGHTER FOR AUTOMOBILES; William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 2, 1912. In which an electric motor of comparatively small horsepower may be employed.

1,217,229. ELECTRIC AIR-HEATING SYSTEM; Elmer J. Smith, Detroit, Mich. App. filed Dec. 3, 1915. Heat is distributed by convection of air directly heated from the electric units.

1,217,241. ALARM SIGNALING APPARATUS; Oliver H. Tracy, Minneapolis, Minn. App. filed Nov. 11, 1915. Improvements.

1,217,255. TELEPHONE SYSTEM; Charles S. Winston, Chicago, Ill. App. filed June 28, 1913. For controlling the ringing of a called-for substation.

1,217,289. CARTRIDGE-FUSE; Alfred L. Eustice, Chicago, Ill. App. filed June 22, 1914. Renewable type.

1,217,301. MAXIMUM-DEMAND RECORDER; Chester I. Hall, Chicago, Ill. App. filed June 18, 1913. Improvements.

1,217,302. ELECTRICITY-MEASURING INSTRUMENT AND TIMING DEVICE THEREFOR; Chester I. Hall, Chicago, Ill. App. filed June 18, 1913. Mechanical gearing and rotating parts are entirely done away with.

1,217,306. ELECTRIC-FURNACE-WALL CONSTRUCTION; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed Sept. 27, 1915. For use in connection with the treatment of phosphate rock to expel phosphoric acid.

1,217,453. STATIC PROTECTIVE DEVICE; Ray P. Jackson, Edgewood, Pa. App. filed Jan. 10, 1916. Lightning arresters that are directly inserted in the transmission line conductors and are devoid of ground connections.

1,217,468. ELECTRODE-HOLDER; John C. Lincoln, Cleveland, Ohio. App. filed July 22, 1916. For electric welding.

1,217,469. TIME-ELEMENT RELAY; Alexander J. Loguin, Norwood, Ohio. App. filed March 23, 1912. To be used in connection with protective devices for electric circuits.

1,217,472. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie, Oak Park, and Frederick H. Loveridge, Chicago, Ill. App. filed April 19, 1906. Interconnection of telephone lines.

1,217,473. CONTROL APPARATUS; Donald H. Mace, Edgewood Park, Pa. App. filed Aug. 29, 1916. Liquid rheostats.

1,217,477. TELEPHONE-EXCHANGE SUPERVISORY SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed July 20, 1916. Semi-automatic systems.

1,217,482. SELF-REGULATING DYNAMO-ELECTRIC MACHINE; Albert Henry Midgley and Charles Anthony Vandervell, Acton Vale, England. App. filed Oct. 30, 1911. Variable speed.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 27, 1917

1,217,483. TRANSMITTING APPARATUS FOR WIRELESS-TELEGRAPH STATIONS; Thomas B. Miller, Seattle, Wash. App. filed Aug. 22, 1914. To arrange well-known devices in connection with associated electric circuits whereby a greater proportion of the energy employed by the transmitting apparatus may effectively be utilized.

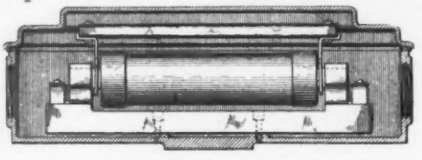
1,217,484. MAGNETO IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES; John Lewis Milton, Tiffin, Ohio. App. filed March 18, 1911. For producing a spark which will be hotter and larger than the sparks produced by the systems heretofore.

1,217,497. ELECTRIC FURNACE; Carl A. Pfanstiehl, Waukegan, Ill. App. filed July 11, 1914. For welding disks of tungsten to the heads of steel or iron tacks, rivets or screws.

1,217,508. INSULATOR; William Schaake, Pittsburgh, Pa. App. filed Feb. 19, 1914. "Strain" or "suspension" type.

1,217,510. TELEPHONE TRUNKING SYSTEM; Michael Schwartz, Chicago, Ill. App. filed March 3, 1913. Improved arrangement of the switches and trunks extending between these switches, whereby more efficient and effective service can be given.

1,217,511. MEANS FOR MINIMIZING INDUCTIVE INTERFERENCE; Charles F. Scott, New Haven, Conn. App. filed Jan. 2, 1915. That may be caused by electromagnetic induction from other circuits located in proximity thereto.



1,217,741—Fuse Holder

1,217,513. SWITCHING APPARATUS; Karl A. Simmon, Wilkinsburg, Pa. App. filed Feb. 19, 1914. Pneumatically operated.

1,217,514. CONTROL APPARATUS; Karl A. Simmon, Edgewood Park, Pa. App. filed Nov. 6, 1914. Liquid rheostats.

1,217,516. TRANSMITTING APPARATUS FOR WIRELESS-TELEGRAPH STATIONS; Frederick G. Simpson, Seattle, Wash. App. filed Nov. 24, 1915. Improvement.

1,217,517. RADIO TELEGRAPH AND TELEPHONE SYSTEM; Frederick G. Simpson, Seattle, Wash. App. filed May 25, 1916. Transmitting apparatus.

1,217,529. ELECTRIC POWER TRANSMISSION; John Godfrey Parry Thomas, Chiswick, London, England. App. filed June 26, 1913. Improvements.

1,217,534. CONNECTOR FOR ELECTRICAL APPARATUS; Samuel Trood, Edgewood Park, Pa. App. filed Jan. 28, 1913. Plug-connector.

1,217,548. TELEPHONE SYSTEM; Charles Adams-Randall, Boston, Mass. App. filed Dec. 6, 1915. Improvements.

1,217,557. ELECTRIC CLOCK; John G. Blessing, Chicago, Ill. App. filed July 19, 1915. A unitary magnet and ratchet mechanism which can be applied as an attachment to different kinds of clocks.

1,217,558. SIGNAL SYSTEM AND CONTROL THEREFOR; Frank E. Boardman, Memphis, Tenn. App. filed June 22, 1916. In connection with elevators.

1,217,566. DISTRIBUTER FOR ELECTRIC IGNITION SYSTEMS; John F. Cavanagh, Meriden, Conn. App. filed June 14, 1916. Improvement.

1,217,573. SEPARATOR FOR STORAGE-BATTERY COUPLES; Walter A. Crowdus, Chicago, Ill. App. filed Jan. 11, 1916. For interposition between the metallic elements of a storage-battery.

1,217,604. TERMINAL FOR ELECTRIC CONDUITS; Frederick I. Johnson, Warren, R. I. App. filed Feb. 14, 1916. Improvement.

1,217,613. AUTOMATIC MAGNETIC SEPARATOR FOR MILLS; Henry O. Little, Bridgewater, Mass. App. filed Nov. 4, 1916. Improvemnts.

1,217,628. SIGNALING DEVICE; James Frank Pereti, Trenton, N. J. App. filed July 22, 1916. Vehicles.

1,217,643. ELECTRICAL WATER-PURIFYING APPARATUS; George J. Schneider, Detroit, Mich. App. filed Aug. 23, 1915. Portable instrument.

1,217,670. AUTOMATIC ELECTRIC GENERATING PLANT; Charles Bell Walker, Solihull, England. App. filed March 14, 1910. Improvement.

1,217,688. ELECTRIC SWITCH; Clarence A. Bates, Bridgeport, Conn. App. filed July 21, 1913. Remote control type.

1,217,701. CIRCUIT-CLOSER FOR DRIP-PAN ALARMS; Henry Brunelle and Edward Brunelle, Turners Falls, Mass. App. filed March 21, 1916. Refrigerator drip pans.

1,217,707. PULL-SWITCH FOR ELECTRIC MINE-SIGNALS; Carl Clausen, Bisbee, Ariz. App. filed April 19, 1916. Novel arrangement of contacts and actuating means for the movable contact.

1,217,715. ELECTRIC SIGN; Samuel G. Crane, Toledo, Ohio. App. filed Feb. 17, 1913. Improvements.

1,217,720. CUT-OUT FOR ELECTRIC INSTRUMENTS, GLOW-LAMPS, AND THE LIKE; Alan John Downes, Croydon, England. App. filed Oct. 11, 1913. By-pass for electric lamps which are to be burnt in series on the ordinary low-pressure supply means.

1,217,738. BATTERY; Joseph M. Flannery, Pittsburgh, Pa. App. filed May 3, 1916. Storage batteries.

1,217,739. BATTERY; Joseph M. Flannery, Pittsburgh, Pa. App. filed May 3, 1916. Storage batteries.

1,217,741. FUSE-HOLDER; Oscar E. Forrest, Schenectady, N. Y. App. filed Dec. 26, 1912. Means for removing the fuse.

1,217,759. DIRECTION-INDICATOR FOR VEHICLES; Cameron G. Hamilton, Seattle, Wash. App. filed May 10, 1915. Improvements.

1,217,775. ELECTRIC INCANDESCENT LAMP; Hugo Kiehl, Chicago, Ill. App. filed April 5, 1916. High illuminating capacity.

1,217,827. CAPACITY-METER; Burchard P. Romain, South Orange, N. J. App. filed Jan. 2, 1915. Direct reading.

1,217,829. LAMP-LOCK; Joseph Sachs, Hartford, Conn. App. filed Feb. 24, 1913. Improvements.

1,217,830. LOCK FOR INCANDESCENT-LAMP STRUCTURES AND THE LIKE; Joseph Sachs, Hartford, Conn. App. filed Feb. 24, 1913. Improvements.

1,217,831. ELECTRICAL CONNECTING MEMBER; Joseph Sachs, Hartford, Conn. App. filed March 13, 1915. Plug such as is insertible into and removable from a socket.

1,217,842. PROCESS FOR CARRYING OUT CHEMICAL REACTIONS; Ottokar Serpek, Paris, France. App. filed Jan. 26, 1914. Between solid bodies and gaseous bodies.

1,217,844. SAFETY FIRE-ALARM BOX; Lovro Shubatt, Centerville, Iowa. App. filed July 3, 1916. Prevents malicious tampering with the signal mechanism.

1,217,858. ELECTRIC REGULATION; John L. Creveling, Auburn, N. Y. App. filed Oct. 24, 1914. Automatically governed in a predetermined manner.

1,217,877. RECTIFIER; Edgar J. Pace, Los Angeles, Cal. App. filed July 21, 1915. Effective means for rectifying such current at high efficiency and with great reliability.

1,217,882. INDICATOR-ALARM; Charles Roma, Memphis, Tenn. App. filed July 28, 1915. Connection with liquid containers.

1,217,890. HIGH-VOLTAGE INSULATING-BUSHING; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 4, 1915. Electrostatic lines of force are precluded from concentrating upon the external surfaces thereof.